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EXECUTIVE SUMMARY

USE OF COMMERCIAL SPECIFICATIONS IN THE NAVAL SHIPBUILDING PROCESS

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This paper describes briefly the method used by the Naval Sea Systems Command (NAVSEA) for acquiring whole ships by means of a performance-oriented specification and a top-level drawing package, together with some 2500 referenced specifications, standards, and drawings. Unique marine features are also cited, such as the effect of an extremely hostile environment and the need for ruggedness, unusual concepts not used ashore, and the reliance on the shipbuilder for furnishing most of the material, machinery, and equipment.

After defining the terminology used, the paper discusses the processing of both military specifications and industry documents. Emphasis is placed upon the involvement of industry, regardless of which type document is eventually issued and invoked.

Following the general introduction to the subject, the paper goes into details of NAVSEA's increasing use of industry standardization documents: materials application, standards for small items, and the general absence of standards for large items of machinery and equipment and the proposed solution; possible use of American Bureau of Shipping (ABS) Rules and resources for design and inspection of ships is also discussed. Finally, some pitfalls (greatly increased personnel involvement, duplication of standards) are examined.

As a separate matter from the use of industry standards, the paper discusses the impetus being given to increased use of off-the-shelf equipment, the pilot program, difficulties with the brand-name-or-equal concept, and the new CID (Commercial Item Description) type of specification.

In conclusion, the paper summarizes the alternatives:
(1) Maximize use of industry standardization documents by direct acceptance, by acceptance with exceptions, or by reference in military documents, as applicable.
(2) Use of CID's, where feasible.
(3) Retention of military documents for mission-critical systems, where a special degree of marine ruggedness is required, and for strictly military equipment.

EXECUTIVE SUMMARY

AUTOMATIC TESTING AND THE WEAPON SYSTEM ACQUISITION PROCESS

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Today's military electronic and avionics systems are extremely complex, and thousands of tests must be performed on them routinely in order to verify their proper operation. Conventional manual testing techniques are often impractical because of the number of tests required, and some form of automatic testing is therefore necessary.

The Air Force is already employing several automatic testing techniques and systems at all levels of maintenance. In fact, the Air Force's reliance on automatic testing has become so great that we invest approximately 75% of our total support equipment acquisition dollars in automatic test systems. The significance of this investment becomes apparent in light of the fact that the Air Force spent a total of $1.1 billion on support equipment in 1975, according to an Air Staff study. Further, this amount does not include the costs of built-in-test (BIT), since this capability is integral to the mission equipment it supports, and its costs are included in the costs of that equipment.

The Air Force acquisition community views automatic testing as a subset of the support function in general. Accordingly, the procedures we have used to identify needs for and to acquire automatic test equipment are the same as those used to acquire all other support equipment. This process requires the prime weapon system contractor to identify all equipment needed to support the system or subsystem he is providing. This approach has caused us some problems. For example:

a. The existing support equipment acquisition process was designed for acquisition of all types of support equipment. Automatic test equipment is vastly more complex than other categories of support equipment, and the existing process does not provide the visibility and controls necessary for its adequate management.

b. The requirements of each weapon system are addressed independently. Each contractor recommends unique test systems designed to the testing requirements of the individual weapon system for which he is responsible. This leads to a proliferation of peculiar automatic test equipments, each of which is capable of supporting only one system.

c. Each contractor has been free to use different programming languages. As a result, our software support facilities have been forced to acquire and become proficient in the use of the programming tools associated with each of the many languages used.

d. Each contractor has used different and, in many cases, proprietary

test programming aids for each system. This practice has made the maintenance and modification of test programs extremely expensive.

In order to address these problems, the Support Equipment SPO was formed within the Aeronautical Systems Division. This SPO has been chartered to manage the acquisition of all support equipment, including automatic test equipment, for all future weapon systems. This consolidated management approach will provide us with the means to minimize the acquisition of additional peculiar automatic test equipment and to insure cross-system application of automatic test equipment to the maximum extent practical.

Additionally, to provide the management tools required for the Support Equipment SPO to achieve these goals, the Air Force established in 1976 the Modular Automatic Test Equipment (MATE) program. This program is being managed by the Support Equipment SPO, and is providing for the development of a systematic approach to the acquisition of all the automatic testing capabilities required by all future weapon systems. Among the products of the program will be a family of hardware and software modules from which test stations can be built to satisfy these requirements. This program will serve as the basis for all future Air Force activities in the realm of automatic testing.

Besides these Air Force initiatives, two Joint Service efforts are also addressing the acquisition of automatic test equipment. The first of these is the Industry/Joint Service Automatic Test Project, which is sponsored by five industry associations. This project has combined the inputs of over 800 people in the ATE community to develop recommendations for improvement of automatic testing within DOD. The final report on this project will be published this summer.

The second Joint Service effort is the Panel on Automatic Testing, which was established by the Joint Logistics Commanders in early 1978. The panel was chartered to:

a. Develop methods for reduction of hardware, software, and manpower costs associated with Automatic Testing for support of Weapon Systems.

b. Devise policies, plans, and procedures for the use of automatic testing hardware and software to improve operational readiness of weapon systems.

c. Facilitate exchange among the Services and OSD of technical, managerial, and operational information on automatic testing hardware and software as applied to the support of weapon systems.

This panel has developed a six year study plan to guide the efforts of all three services in improving the effectiveness of automatic testing throughout DOD. The Air Force's MATE program has been fully integrated into this plan.

Through all of the aforementioned efforts, the Air Force is scrutinizing the current policies and procedures used to acquire and employ automatic testing capabilities and the associated systems. It has become apparent that we can no longer afford to address the requirements of each weapon system separately; we must consolidate the management of automatic testing to assure more economical testing of our weapon systems. Within the Air Force, this will be accomplished through the MATE program and its interface with the Joint Servic efforts.

EXECUTIVE SUMMARY

CONSIDERATION OF THE INDUSTRIAL BASE IN FORMULATING THE FIVE-YEAR SHIPBUILDING PROGRAM

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The U.S. Navy, like the other Services, is reliant upon a strong and resilient industrial base for the construction and maintenance of its ships and weapons systems. The industrial base for ships comprises public and private shipyards, supporting industries in basic materials and manufactured components, and a number of naval architecture and design firms. With the exception of the public shipyards this industry supports commercial and governmental ship design, construction and repair.

From the military viewpoint the adequacy of the industrial base is viewed not only in terms of its ability to meet current needs, but also its ability to expand to meet full or partial mobilization requirements. The present low demand, worldwide, for merchant ships coincides with substantial reductions in the numbers of Navy ships which are planned for construction. The forecast loss of employment levels in the industry is expected to result in reduction of the base through closure of some shipyards and the diversion to other business of the supporting industries. The low level of ship design development resulting from reduced building programs will cause similar contraction in the design and engineering sector of the industry.

Peacetime priorities make it unlikely that the industrial base can be protected as a reserve capability, unless it also meets peacetime demands which pay its bills. Even with wartime or quasi-wartime policies in effect, the industry expands slowly, as was demonstrated in the decade from 1936 to 1945. It is highly labor-intensive, and involves high skill levels, which inhibits rapid expansion rates.

Given the circumstances, the government should do what it can to nurture that part of the industry which it can support with current requirements. More effective long-range planning for ship acquisitions, and greater adherence to established plans will serve both to strengthen the industry and to reduce unnecessary cost growth.

Although the Five Year Defense Plan (FYDP) is prepared to establish a perspective for the annual budgeting process, the shipbuilding program portion of the FYDP undergoes significant change each year. Budget constraints and the lack of a concensus on the future Navy mission are the principal causes for this fluctuation. The mechanism for proposing and determining alternatives, once the Navy budget

has been submitted, demands very rapid response, and allows program justification only at a very summary level. Usually, military mission need dominates such exchanges and little consideration is given to optimum procurement lead times and profiles.

Early stages of planning involve analysis of industrial capacity and capabilities; and the Navy's proposed budget is formulated after considering such analysis. Subsequent perturbations to the plan are handled without such consideration, primarily because the ability does not now exist to perform meaningful analysis of alternatives in the time permitted. The result has often been compression or stretch-out of a shipbuilding program which adds to its cost and prevents effective industrial planning by the shipbuilding industry. Such events discourage the investment of capital in modern production facilities, and damage the Navy's estimating credibility.

Present methods of analysis are time consuming and involve assumptions of workload distribution for both Navy and commercial work in the private shipbuilding industry. Assessment of the Navy's preferred plan requires nearly a month, and subsequent variants require two weeks, on the average. An industrial analysis of the preferred five-year shipbuilding plan has been provided annually to the Chief of Naval Operations for the last two years. Additionally, work has begun on methods to take better advantage of industrial capacity and capability when formulating the long-range shipbuilding plans. This will entail a balancing of foreseen shipbuilding capacity with the best estimate of the numbers and types of ships to be built, in order to develop the most effective distribution of the ships by year. If such information were considered along with other budgetary and strategic factors, it is expected that economies would result.

More rapid analysis of the industrial effects of changes to the plan is also needed in order to respond effectively to the alternatives developed in the budget process. The national debate over the future Navy mission and competing service requirements make it likely that such perturbations will continue to be a feature of budget planning. Forecasting the distribution of Navy shipbuilding work in the private sector entails risks of uncertainty and of possible misuse or misinterpretation. Despite these risks, the availability of meaningful analytical information should permit better informed decision-makers to stabilize the Navy shipbuilding program and gain the cost avoidance benefits such stability will provide.

Synergistically, stabilization of the shipbuilding program should create a business climate more conducive to investment and result in added strength for that part of the industrial base which survives the current contraction.

EXECUTIVE SUMMARY

BUYING COMMERCIAL: WHAT WORKS AND WHAT DOESN'T WORK

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INTRODUCTION

There's a popular perception that if a committee put together a horse, they'd end up with a camel. In recent times, that same perception has applied to Government specifications for commercial products. While the Defense Logistics Agency (DLA) hasn't bought any Government specification "camels," we are in the business of buying large volumes of commercial and near-commercial products for the Military Services—approximately $8 billion in FY 78.

Consequently, DLA has been closely involved in the push by the Office of Federal Procurement Policy (OFPP) since May 1976 to re-evaluate the role of Government specifications in acquiring commercial products. Minimizing Government specifications for commercial products is not a new idea but rather a recurring theme. Many studies and papers, such as the Report of the Commission on Government Procurement in 1972, have discussed the desirability of eliminating Government specifications. Few of these however have operationally tested their speculations.

For two years, DLA has been conducting a pilot test implementation of the OFPP policy on Acquisition and Distribution of Commercial Products (ADCP). The test is designed to give us documented cases of buy commercial efforts sans traditional specifications.

At the outset, DLA anticipated that even a limited test would present some interesting challenges. As it turns out, however, that early forecast fell short of fully recognizing the domino effect throughout the acquisition and logistic system which occurs when one element is changed.

The purpose of this paper is to report the preliminary results obtained from procurements of such commonly available commercial items as soy sauce, underwear, chain saws and fuses. The test has not been conducted as a scientific study in a controlled environment, but instead operated in the real world of military logistics. While results may not be statistically valid, the actual test procurements using varying techniques have provided some meaningful data which should help shape future implementation direction in "buying commercial."

DLA STUDY DESIGN

DLA has evaluated 72 items to date to determine whether it was possible to make a one-time test buy. The items were subjectively selected using three basic criteria:

-- Currently procured to a Federal or military specification

-- Reasonable potential of locating acceptable commercial items

-- Reasonably high level of annual usage, preferably in excess of

$10,000 — so that we could conduct several buys in a formally-advertised environment.

On every item some market research was performed to assess commercial product availability. The depth of research and techniques used varied from item to item. However, generally commercial suppliers, commercial users and industry associations were tapped to furnish information.

Based upon the results of the market research, several different "buy commercial" acquisition techniques were developed and coordinated with the Military Services. Table 1 reflects the alternatives used in the pilot test.

Table 1. Alternate Acquisition Strategies

Alternative	Application in DLA ADCP
Multiple Award Schedule	X-Ray Film Food Service Equipment
Brand Name or Equal/Purchase Description	Bath Towel Plumbing Supplies Soy Sauce
Non-Government Standards	Fuses Automotive Gasoline Electrical Conduit
Professional Panel Evaluation	Surgical Forceps
Tailored Government Specification	Forklift Trucks

A key phase of the pilot program is customer feedback. With a significant amount of help from the Military Departments in publicizing the program, we are now starting to obtain feedback from our military customers. While final results are not expected until October 1979, preliminary results do allow an assessment of future implementation techniques.

Additionally, on early successful items, we have already provided results and a recommendation for permanent adoption of the commercial acquisition technique and cancellation of the Government specification to the Military Services.

RESULTS - WHAT WE KNOW NOW THAT WE WISHED WE KNEW THEN

One of the driving factors behind the "buy commercial" policy was to get a better buy for Uncle Sam. Due to the variety of factors and conditions such as overall economic conditions and trends, inflation and market forces that contribute to price differences, it's very difficult to isolate and assess the effect of the change in buying techniques. Across-the-board there does not appear to be a definitive price trend. In selected commodity areas where significant changes to specification marking, packaging and quality assurance were made, lower prices were generally obtained. However, to determine overall cost savings, much analysis still needs to be done to evaluate the price/quality tradeoffs, user satisfaction and resources required to develop and use the buy commercial strategies.

The quality of many commercial products is still being assessed. To date, however, there have only been two cases of complaints concerning the items themselves. We have experienced more problems with commercial packaging, but believe we may be able to resolve most of these.

The quality question ties in closely with what we still perceive to be the greatest impasse to going commercial — interface with the socioeconomic programs. At stake is the validity of the assumption underlying the buy commercial policy. It assumes that products which have passed the test of competition and have been accepted in the commercial marketplace should also be acceptable to the Government consumer. The policy postulates that detailed specifications are therefore not needed either to acquire the item or to ensure the quality of the item. Our problem is that many small business suppliers to DLA have never expanded their markets to the commercial sector; although they have regularly produced commercial-type items to our specifications. Their products under an ADCP brief purchase description will face neither the rigors of the commercial marketplace, nor the exacting quality assurance requirements of a Government specification. We have no basis to exclude those non-commercial suppliers who have supplied satisfactory items in the past; yet what happens to long-run quality under the relaxed specification approach? This can only be determined over time.

There does appear to be some increased bidder response on the ADCP solicitations. However, there is much to be done in the world of Government procurement, if we are truly to become a more attractive customer. Several surveys have shown that specification changes alone will not solve the total problem. Industry lists factors such as lack of continuous contractual relationships, solicitation at peak seasons, mandatory socioeconomic programs and excessive paperwork requirements as discouraging greater bid response.

CONCLUSION

As a bottom-line to our pilot test effort, we are attempting to forecast which acquisition techniques hold the greatest potential for implementation of ADCP. The Multiple Award Schedule technique which permits selection of items by brand name has several disadvantages which must be resolved such as developing better pricing techniques, collecting demand data and lessening the administrative burden on the user. The brand name or equal technique has pitfalls in the area of evaluating alternate offers in the absence of complete technical data. The efficacy of commercial market acceptability criteria has been questionable where non-commercial suppliers are involved. Commercial Item Descriptions still require further DoD guidance before the technique can be implemented on a broad scale. That leaves two major alternatives: non-government standards and tailored specifications. Several pilot test buys have documented the success of these techniques and we expect to rely heavily on them.

Generalities are difficult, however, because there is no single right way to buy commercial products. Flexibility is paramount. In some cases, we have the flexibility today to exercise commercial buying techniques. In others, however, a re-examination of the total system of statutory and regulatory constraints to which Government buying responds must be made to achieve optimum implementation of buying commercial.

EXECUTIVE SUMMARY

THE USE OF FIXED PRICE-TYPE CONTRACTING BEFORE COMPLETION OF PRODUCTION PROOFING

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There appears to be an increasing trend in DOD procurement toward the use of fixed-price-type contracts for initial production before the design has been proofed in an actual production environment. The security of the ceilings and sanctions of fixed price contracts is meretriciously attractive to DOD agencies as a means to avoid cost growth or overruns. But if this type of procurement is used before adequate performance history is available, particularly where high technology products are involved, it may still ultimately result in total program cost increase through pricing contingencies; or additional administrative expense and delay through Contractor default; or litigation and claims. Not much of a bargain for the Government, and not much consolation to the Contractor or the empty-handed user.

The theory that fixed-price-type contracting will end cost overruns has been advanced before, of course, and has proven itself unrealistic and more troublesome in the long run.

DAR (ASPR) 3-808.6(a) indicates that the generally accepted progression of contract types is Fixed Price Incentive for initial production; Fixed Price Incentive or Firm Fixed Price for follow-on production and Firm Fixed Price for supply. But transitioning to production is always a challenge, and estimating initial production is just as challenging. It is a combination of knowns and unknowns, trying to assess what problems might arise and how disruptive or costly their resolution might be, and working with sometimes untested suppliers to establish their ability to deliver a quality product on time at an affordable price. Hardly a suitable environment for introducing fixed-price-type contracting. Yet, the DOD agencies feel more secure when the Contractor is signed up for a fixed-price-type contract, because there is an obvious, identifiable limitation on the Government's liability, in the ceiling price or the firm fixed price.

Until the initial production contract is complete, required production rates have been achieved, and all the costs are in, there can be significant variability in program costs which can mean windfall profits or disastrous losses to the Contractor under fixed-price-type contracts. In the case of windfall profits, the Government paid more than it should have, because it insisted on a fixed-price-type contract. In the case of disastrous losses, a large Contractor might survive, but a small business, with limited credit or capital reserves might not.

For a number of reasons, then, the early progression to fixed-price-type contracts appears inappropriate, and there is a sound logical basis for deferring their use until meaningful experience in production is obtained.

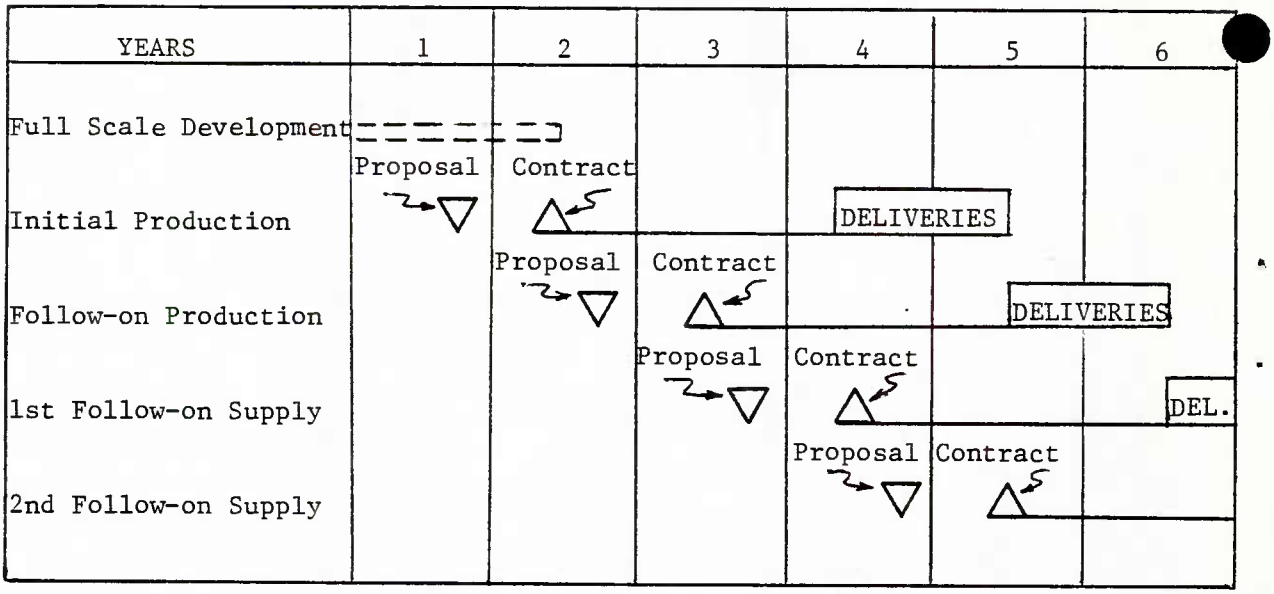

FIGURE I

TYPICAL ACQUISITION SCENARIO

As Figure I shows, assuming a procurement lead time of 24 months to first end-item delivery, even a proposal for the second follow-on supply contract must be prepared on the basis of very incomplete data from the initial production contract. At the time the proposal is submitted, considerably less than half the initial production quantity would have been delivered, particularly if there is a ramp-up over the early delivery period to the maximum delivery rate. In the past, a 24 month production lead time may have been a rarity except for very complex systems; but the fact is that more and more suppliers today are lengthening delivery lead times for piece parts and components, including such basic items as castings and connectors, with the result that primes are faced with the reality of longer and longer procurement lead times for their end items than ever before.

What DAR terms the "generally accepted progression" of contract types clearly needs to be reconsidered. Fixed-price-type contracting for complex systems should be reserved for those situations where the design has been proofed in production and should not be introduced prior to the time that data are available to permit accurate and reliable cost forecasting. The use of properly structured and realistically negotiated cost-reimbursement contracts for development and for one or more early production contracts is the most practical, realistic, and effective way of assuring that the acquisition needs of the Government will be met in a timely manner and within original cost targets.

EXECUTIVE SUMMARY

GIVE ME YOUR GRANTS, YOUR AIDS, YOUR HUDDLED MESSES

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Contracts and grants personnel in civil agencies and the Department of Defense (DOD) have available varying field administration capabilities. Current public attention, focused on mismanagement of grant and aid programs, fails to identify any specific underlying shortfall in program field administration policy, procedures and manpower. Media attention to changes in executives and government planning for long term solutions seems to overshadow the short term remedy associated with the use of procedures and skills currently in use by DOD at the field administration level. Of course, no research would be complete without an examination of the alleged shortcomings in DOD's field administration capability.

PRESENT CAPABILITY

There exists some 25,000 personnel in the DOD Contract Administration Services (CAS), almost all working in organizations identified in the DOD Directory of Contract Administration Services Components. Pending publication of a complementary or an all-inclusive federal-wide directory, even the approximate number of government personnel and the identification of the civil agencies performing similar services cannot be ascertained. Current efforts by DOD to identify the civil agencies performing administration services for interagency servicing of contracting personnel have only progressed to the point that it is apparent that there are significant differences in field administration capabilities between civil agencies. Although the Office of Federal Procurement Policy (OFPP) announcement on interagency support essentially tasks DOD contract administration personnel to support the civil agency contracting effort, the present DOD services and staffing is structured to support the present DOD programs. Meanwhile, civil agency contracts and programs have increased and expanded without the benefit of a field administration structure for the agency contracting and grant officers to draw on for support through delegation. To supply a geographically disbursed field administration capability for all government contracting officers and grant administrators adjustments will have to be made to define not only the types of field administration services to be made available, but also the staffing and talent issues must be addressed.

EXISTING BASELINE

To get on with the work of providing the civilian agencies with the field administration capabilities needed to improve contract and grant management, the existing Defense Acquisition Regulation (DAR) needs to be tailored to include civil agency needs. This is an interim solution pending availability of the Federal Acquisition Regulation (FAR). The position that the services

outlined in DAR 1-406 should be the starting point, in no way presupposes DOD would eventually provide the total federal capability. The contract administration functions in DAR 1-406 (better defined for this paper as field administration services) are used as a baseline because they have been developed systematically over time and have proven satisfactory as delegations by the contracting officer/program manager to the on-site administrator and his organization. The sixty-nine delegations available to civilian and defense acquisition personnel can be stratified in several fashions. To understand which functions would be the most useful or require modified action to provide better accommodation of civil agency contracting and grant personnel, the following breakdown is provided:

TABLE I - CATEGORY BREAKDOWN

CATEGORY	NO. OF FUNCTIONS	PER CENT
Organization Review	28	40
Organization Submissions Review	15	22
Functions Delegated to Field	26	38
Totals	69	100

From the above analysis, it can be seen that most of the functions are associated with the review of the party to the government contract or agreement as an organizational entity. The bulk of this effort is in developing the necessary assurances in the contractors' accounting and management systems that contract performance can be expected, at reasonable and predictable costs. Of the organization review category, 43% are reviews of cost determination, accumulation and payment systems. The two other categories yield even higher cost determinations, accumulation and payment efforts. What has been shown in this summary is that the present DAR 1-406 functions are over one-half (52%) directed at the cost ills currently plaguing the civil agency contracting and grant management personnel, with a significant portion (40%) directed at organizational management. The results of this research clearly indicate the DAR 1-406 function should be the baseline for federal field administration of contracts, grants and aid.

TAILOR BASELINE

Since the best alternative seems to be to modify the DAR 1-406 functions to better accommodate civilian contracting and grants personnel, the second area of this research is directed at modification possibilities and their merits. The table below summarizes the conclusions of this effort:

TABLE 2 - TAILORED FUNCTIONS

TAILORING	NO. OF FUNCTIONS	USEFUL TO NON-DOD
Requiring no change	39	23
Requiring minor change	26	26
Requiring substantive change	4	4
Totals	69	53

To summarize this effort, it can be said that organizational entities, whether a defense or nondefense contractor, educational or nonprofit institution or state or local government, all will require cost and management systems which can be subjected to organization review under altered DAR 1-406 functions. In the organization category, only one DAR 1-406 function needs substantive modification. All organizations can likewise be subjected to the types of field reviews of submitted data and reports which contribute to effective total management by civil or DOD contracting or grants personnel. Here only one function needs substantive modification.

Finally, the last group requires substantive modifications in two functions. Since the timing of the OFPP interagency policy pronouncement is such that staffing buildup and reimbursement policies need to be developed, gradual assumption of the civilian workload is appropriate so that budget adjustments can be made to accommodate added staffing, training and reimbursement funding considerations.

CURRENT AND LONG TERM SOLUTION

The OFPP (in an initial effort in December of 1977) called for heads of the executive departments and establishments to utilize interagency support in the placement and administration of contracts. While some current non-DOD capability exists, it is in no way comparable to the structure and sophistication which is present in DOD for the administration of contracts. The Federal Acquisition Institute (FAI) is seeking a long-range solution to procurement and grant management through a federal-wide program which would establish minimum and desired levels of training for the performance of certain acquisition responsibilities. However, the FAI effort will not result in an immediate turnaround of the present non-DOD shortfall in administrative organization and skills. The projected long term effort of the FAI should consider recruiting, internship and training programs directed at DOD and non-DOD administration commonality. Priorities should be established which will provide eventual government-wide capability and flexibility related to handling workloads emanating from the budget mix. The DOD and non-DOD programs should be natural partners in contract and grant administration because of a joint ability to support a consistent staffing level in skill and numbers for field administration, a capability which neither possesses alone, as budgets reflect the national defense or social needs of the time.

Although long term efforts will result in organizational structure and staffing offering field administration to all federal agencies, the short term improvement possibilities rest with the existing DOD structure, policies and skills. Thus, without knowing exactly what is over there in the varied civil agency programs, the beckoning call of the Statue of Liberty seems worthy of providing the needed optimism. "Give me your tired, your poor, your huddled masses, yearning to be free. The wretched refuse of your teeming shores, send these--the homeless, temp-tost, to me. I lift my lamp beside the golden door."

EXECUTIVE SUMMARY

PROPOSED SYSTEM ACQUISITION MANAGEMENT INFORMATION SERVICE CENTER (SAMISC) WILL IMPROVE ACQUISITION PROCESS CREDIBILITY

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The inaccessibility of system acquisition management (SAM) information has resulted from the interaction of four factors: the increasing need for SAM information, the availability of modern tools for processing information, the nature and existence of SAM information, and the nature and location of information sources. SAM information exists largely as kernels of information embedded within the overall mass of universal information. To be used effectively the SAM information must be located, extracted, analyzed, and refined into a form suitable to fit the user's needs. The sources in which SAM information is embedded number in the thousands; see Figure 1. These sources are scattered, unconnected, often redundant, and uncoordinated. The interfacing of these incompatible, obsolescent information sources with modern information handling tools causes the inaccessibility problem.

The proposed information system will provide the user with a single point of access to all major sources of SAM information. The system concept calls for evolutionary development of a system acquisition management information services center (SAMISC) in three stages as indicated in Figure 2. In the first stage a basic system will be developed to service primarily the Defense Systems Management College (DSMC) and

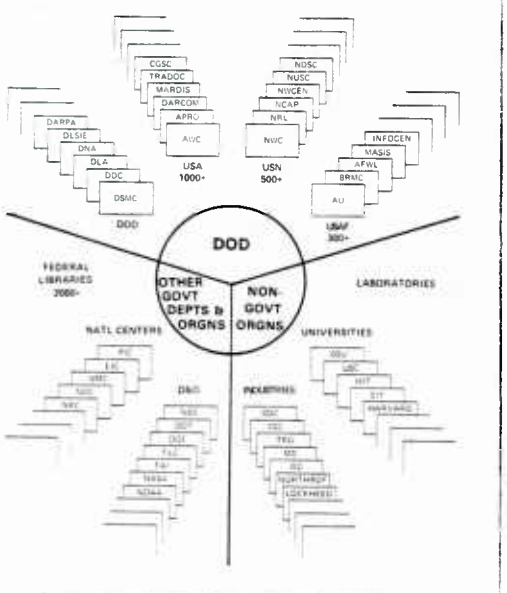

FIGURE 1. SAM INFORMATION SOURCES ARE NUMEROUS

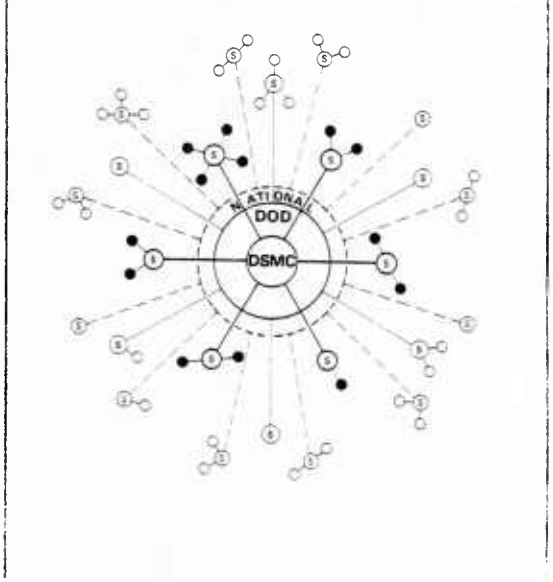

FIGURE 2. THREE-STAGE SYSTEM DEVELOPMENT CONCEPT

to provide a proven baseline system for expansion into a DOD system. The DSMC system will provide access to existing sources of SAM information. The second stage DOD system will be developed to net with other DOD sources and to function as a prototype for expansion into a National system if feasible and desirable. The DOD system will add existing sources to those accessed in the first stage. The third stage National level system is subject to sponsorship of the Federal Acquisition Institute (FAI) or some other federal agency if desired, and would be developed to service all of the federal government and non-governmental organizations and agencies involved with acquisition management information. It would encompass all of the DOD system and add numerous additional sources to the DOD net.

The services concept is similar to that of the legal information services provided by the U.S. Air Force operated Federal Legal Information through Electronics (FLITE) system. The SAMISC will provide a single point of contact for users needing access to acquisition management information. The SAMISC will be contactable electronically at all times; contact by other means, e.g., telephonic means, will also be available during normal operating hours. Provision will be made for storage of queries during periods outside of normal operating hours. SAMISC users will not need any special training for use of the services. Response time during normal operating hours will be limited only by the capabilities of the data processing and communications systems employed. Each query will elicit one of two responses. If the requested information is available electronically in the SAMISC system, a direct reply to the query will be made with specific information. Otherwise, the requestor will be provided information as to the best source(s) of the specific information.

To minimize risk, it is planned to utilize state of the art technology, and existing data processing systems and communications systems insofar as practical. On the basis of cost savings, reasonableness of cost, and time savings, it has been determined that the system is affordable. The system will provide substantial benefits to the users in terms of improved management of information resources, easier and quicker access to information, and increased visibility and communication among acquisition managers. Based on these benefits, it is recommended that:

- DOD proceed with development of the DSMC level SAMISC as the first stage in the evolutionary development of the DOD level system
- DSMC be designated as the focal point for DOD system acquisition management information
- FAI be encouraged to sponsor, or to arrange a sponsoring organization for the National level system.

EXECUTIVE SUMMARY

INHIBITORS TO THE USE OF LIFE CYCLE COSTING: RESULTS OF A SURVEY OF MILITARY/INDUSTRIAL MANAGERS

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Introduction: This paper reports the results of a survey of congressional staff, DOD members, and industry conducted to determine the inhibitors to implementing life cycle cost in material acquisition in government. The survey concentrated on program managed systems and solicited opinions pertaining to guidance, tools, motivation and criteria. Over three hundred responses are included in the report.

Problem: The DOD system acquisition review procedure (DSARC) includes a look at the actual experienced cost and schedule growth on a project managed system's research and development effort versus that which was originally projected. This review is normally presented as an examination of the deviation or variance from the original cost projection.

System reviews do not normally require a presentation of an expected life cycle cost with a variance and cause analysis, although this appears to be the intent of DODD 5000.28. The actual carrying out of the design to cost policy of DOD appears to be through monitoring "Design to Unit Production Cost". If this is so, clearly the impact of the high operating cost will fall on the operational community but more generally on the service and DOD as a whole. The impact of a higher Life Cycle Cost on the total force will be a reduction of funds available to sustain other elements of the force.

Findings and Conclusion: The report concludes that a very low percentage of managers presently believe decision makers attention is directed to long term cost. Problems appear to exist that hinder such long range planning. The following areas are seen as inhibitors to desired Life Cycle Cost implementation:

(1) Predicting and verifying life cycle costs and savings.

(2) Gathering valid and reliable data.

(3) Getting continuous and sufficient program funding through DOD.

(4) Lack of a workable implementation policy.

(5) Lack of management perserverance at implementing levels.

Recommendations: As a result of the survey findings and conclusions, the author has recommended the following:

(1) That DOD issue an implementing instruction to DODD 5000.28. That the implementing instruction be provided as guidance for project managers or "high cost system" developers. The instruction should provide the needed guidelines for making life cycle cost a parameter for minimization during development.

(2) That DSARC/Service SARC require that a Life Cycle Cost Model be identified and if necessary modified for the specific system. This model should be specified in the DCP when coordinated for signature/ approval and used by the system PM and industry.

(3) That the PM include Life Cycle Cost minimization as an element in the RFP/contract with industry.

(4) That Project Managers use a criteria of: more than 5:1 projected pay back to investment ratio with less than a five year pay back period.

(5) That each Service's System Command: a. Permit use of "risk capital" and M account funds for Life Cycle Cost reductions when justified by the above criteria and cost model. b. Require presentations at program reviews to show deviations from the projected LCC.

(6) That policy makers and Congress make Life Cycle Cost a key parameter in system development. That any funding changes be made with full realization of the impact to Life Cycle Costs.

(7) That industrial contractors: (a) Use Life Cycle Cost models in decision making. (b) That industry program reviews with the government address the changes to the predicted Life Cycle Cost expressed in the proposal. (c) That high pay-off opportunities be presented to the Government PM when the investment is beyond the scope of the existing contract.

EXECUTIVE SUMMARY

"AFFORDABILITY OF MAJOR SYSTEMS"

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As early as 1971, DOD Directive 5000.1, "Acquisition of Major Defense Systems," recognized that system cost should be a factor in trade-off decisions. In 1973, "Design-to-Cost" became an element of importance prior to entering full scale development (FSD), and subsequently life cycle cost (LCC) became recognized as perhaps the predominant feature of total systems cost. In 1977, DOD Directive 5000.2, "Major System Acquisition Process," delineated affordability objectives and specified that acquisition and ownership costs are to be separate cost elements prior to FSD phase. Cost growth of these elements was considered by the Defense Science Board Summer Study in 1977 which reinforced the concept of "affordability."

Finally, the recent draft of DOD Directive 5000.1, "Major System Acquisitions" would have the affordability of a major system to be determined at each milestone decision point. Some elements of affordability would be the projected share of the defense budget for the systems' mission areas and the projected LCC of the system. Thus, it is clear, that within the past decade, the realization of escalating costs in major systems acquisition require that total system costs become a determinate factor in the choice of future systems needed to assure the nation's security.

This paper examines some of the facets of affordability, the importance of the concept to both the military and industry, suggests operations research techniques to examine the threat, and in particular to determine the "consequences" of defeating a threat, as this could be of greater importance cost-wise. Finally, the interrelationship of A-109 (and MENS) with affordability, is pointed out.

The history of cost growth in U.S. weapons systems demands that a serious effort be undertaken to determine cost drivers of this growth and means to curtail them. "Affordability" as a concept, if carried out affirmatively, will tackle the problem. Its predominate aspects are acquisition and ownership costs plus budget availability. Another important feature is to require a decision at Milestone II to enter FSD only with programs intended for deployment. Thus, out-year costs are a major consideration and budget availability is a prime influence on the survival of the system.

The major factor in cost-growth, and perhaps the least documented and understood is ownership cost (operations and support). A meaningful data base must be established and must include information from not only the development agency, but also user, support and planning agencies in order to provide a sound total system cost structure.

The affordability concept is important because it would prioritize programs at an early phase (prior to Milestone II), and thereby assuring budget availability for systems we can afford.

Other very important by-products of affordability would be stabilization of the industrial workforce because of a reasonably constant level of development and production programs with also stability in the planning process. These items would have a favorable impact on costs, as "surprises" during and after development, would be precluded. Prudent application in planning, and the recognition of technical risks, would allow proper budget allocation in areas requiring additional efforts.

A question arises as to the total cost of a system. Its worth would be assessed at Milestone 0, with guidance furnished to industry at MENS approval. More reliance should be put on industry to ascertain the state-of-the-art in assisting the DOD to determine what can and cannot be achieved. Continuing dialogue with industry in updating system costs should provide reasonably firm numbers at Milestone II.

It is important for industry to understand that MENS approval only affirms a long-term need and not a program commitment.

In summary, the concept of "affordability" is sound but it must be implemented from the top down to be workable. Major emphasis must be placed on better estimation of operating and support costs, as these are the prime cost-escalators. The concept, when applied appropriately and with determination in all phases of the acquisition process, will assure that we will be able to deploy adequate systems in support of national security.

EXECUTIVE SUMMARY

AN INFORMATION SYSTEM FOR ACQUISITION RESEARCH

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This brief study was undertaken in support of the work of the Logistics Management Institute on a contract from the Federal Acquisition Institute. It is part of the first phase of a planned project on the design of improved mechanisms needed to meet the information needs of the Federal Government's acquisition community. This report contains the results of a broad conceptual analysis on this issue and was not undertaken with a prior bias for or against any particular existing or potential Acquisition Information System (AIS). One of the guiding questions underlying the study was whether there was a need for an entirely new AIS or primarily a need for strengthening the existing set of AIS and related mechanisms through some sort of improved networking or coordinating arrangements.

The work was divided into 6 tasks: 1) Define the population of potential users; 2) Determine the information categories needed by the various segments of the acquisition community; 3) Collect information on existing retrieval systems and information centers for acquisition research; 4) Obtain and review current models of the Government acquisition process; 5) Prepare and present a conceptual analysis of the acquisition research information retrieval process, identifying the needs to be satisfied; 6) Prepare and present development plan guidelines for designing, testing, and implementing an information retrieval system for the Government acquisition community.

Most of the interviewing of users in the various categories described in the report was conducted by telephone. In addition, several meetings were held in Washington with key members of the acquisition community. Documentary sources included: library user data, reports, articles, symposium papers, etc. Finally, IASTA members drew upon their many years of experience with: the acquisition process, design of information systems, and research and consulting on the overall R&D/Innovation process.

The definition of the "user" population in the acquisition area is far from a simple task. Clearly, some individuals and groups are more easily identified than others, because their work is entirely devoted to the acquisition process or stages thereof. These general categories of people have been included in the "acquisition community" for purposes of this study--researchers, policy makers, and operational personnel.

A list of federal organizations which may be considered candidates for the use of acquisition information was obtained by phone interviews, by scanning selected literature items, and by contact with knowledgeable members of the acquisition community.

Users of acquisition information obtain acquisition-related data from a wide variety of sources, which we have classifed as internal or external to the

organization. These sources are used depending on such criteria as ease of access and perceived availability of information. The majority of the respondents in our survey reported the regular use of one or two external sources. Few are attempting to search for additional sources. Popular channels for obtaining updated information (particularly by federal people) are government-sponsored seminars and conferences.

Respondents in our survey also believe that the large number and variety of acquisition-related data systems in the federal network make it rather difficult to make a proper selection of a data system that would provide needed information. There seems to be a heavy reliance on internal sources, particularly where the problem or need for information is urgent, although routine. The main channels in the internal environment are individual interaction and internal studies, files, and publications. Most of those interviewed reported that they routinely share information with their colleagues, both formally and informally, particularly data obtained from external sources. Recurrent themes in our survey were 1) users who are unaware of existing data systems outside their own organizations, and 2) the many barriers to the satisfactory utilization of acquisition information.

Much of the information required by the operational people interviewed by us relate to pre-award and contract administration, including performance evaluation phases. Besides information on the latest rules, strategies, directives, standards, etc., which might be relevant to them, they also require comparative data on costs, schedules, time, etc. People at the policy level ensure that the acquisition activity within their organization follows overall policy directives and efficiently meets requirements. Besides updating their information on policies, reports, potential sources and problems, they also need a lot of aggregated statistics to reply to congressional and other inquiries. At this level, acquisition may only be one of the several functions performed. There is often an information overload in terms of raw data and there is a lack of uniformity of data from different sources due to different accounting and/or coding procedures. The researcher is interested in the information required by both of the other groups--the operational and the policy people--depending on his areas of specialization or the problem he is working on. He is also interested in allied disciplines and case studies.

The study presents a summary or overview of existing information systems which serve the acquisition community. Several dozen such information systems are identified and their major characteristics are discussed in general terms. Five examples of acquisition models are given and the information needs of acquisition system personnel are described for: acquisition managers, policy makers, and researchers. A conceptual analysis of the acquisition information process is given, including objectives of such a system and some design concepts. Finally, a plan for designing, testing, and implementing an Acquisition Information System (AIS) is presented in terms of criteria (what do we want to accomplish with and through an AIS); constraints on the design; and design features. Several key issues in design of an AIS are discussed and guidelines are given for full scale design, testing, and implementation.

EXECUTIVE SUMMARY

WORK DENSITY AND ITS EFFECT ON SHIP CONSTRUCTION COST AND TIME

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INTRODUCTION

The time it takes to construct a ship is often geared to the budget cycle. The purpose of this paper is to determine the benefits which could be achieved by selecting the optimum time for construction. A mathematical model is presented for determining optimum building time. The model is used to illustrate the variation of the two major time-sensitive cost groups with construction time and workforce level.

It is well known that the cost of building a ship varies with the length of time of construction. An optimum construction time period exists where the total cost is a minimum. It is important for both shipyard planners and for the customer to be able to compute the optimum time of construction for a given ship or class of ships. In addition, having the ability to predict quantitatively incremental costs associated with an accelerated or extended construction time can prove to be useful.

In this paper a simple mathematical model is developed that enables the shipyard planner to compute the construction cost as a function of construction time using simple parameters derived from production data. Production Rate (R) is expressed in terms of workforce level (W) using a universal (normalized) curve that takes into account the dropoff in production rate with workforce level due to crowding and worker interference. The normalization is accomplished using the maximum production rate (R_∞) and the concept of a critical workforce level (W_{cr}). The normalized production rate curve is written in equation form as

$$R/R_\infty = \tanh\,(W/W_{cr}), \qquad (1)$$

where R, is the production rate in units of ships produced per unit time and W is the workforce level in units of (say) worker-days per day. The symbol "tanh" indicates the hyperbolic tangent, which models the dropoff in productivity as the workforce level increases.

Maximum production rate was found to vary with critical workforce density α (work density), work area (A) and low density unit labor cost (K_0), all of which are easily measured or estimated. The critical workforce level is related to critical work density and work area. Critical work density (α) is given as

$$\alpha = W_{cr}/A, \qquad (2)$$

where W_{cr} is the critical number of workers, which can be defined as the number of workers where the production rate is 76.2 percent of the maximum.

Costs in this simplified model are broken down into two components: labor costs (C_L) and indirect or carrying costs (C_I)

$$C_T = C_L + C_I, \tag{3}$$

where C_T is the total cost. (Material costs are not taken into account, as they are not dependent on construction time or workforce level.) Indirect costs are costs related to overhead and to the degree of capital intensity of the ship construction facility. Labor costs for a fixed workforce level are proportional to construction time. Total labor costs vary with workforce level because of work density effects. A minimum construction time (T_{MIN}) exists, given as

$$T_{MIN} = N/R_{\infty}, \tag{4}$$

where N is the number of ships produced and R_{∞} is the maximum production rate.

The optimum construction time is shown to be a consequence of the tradeoff between labor costs which drop off as the construction time increases and indirect costs proportional to construction time. The optimum tradeoff in construction time is a function of the relative level of fixed costs, characterized by the nondimensional parameter β as shown in the following Figure:

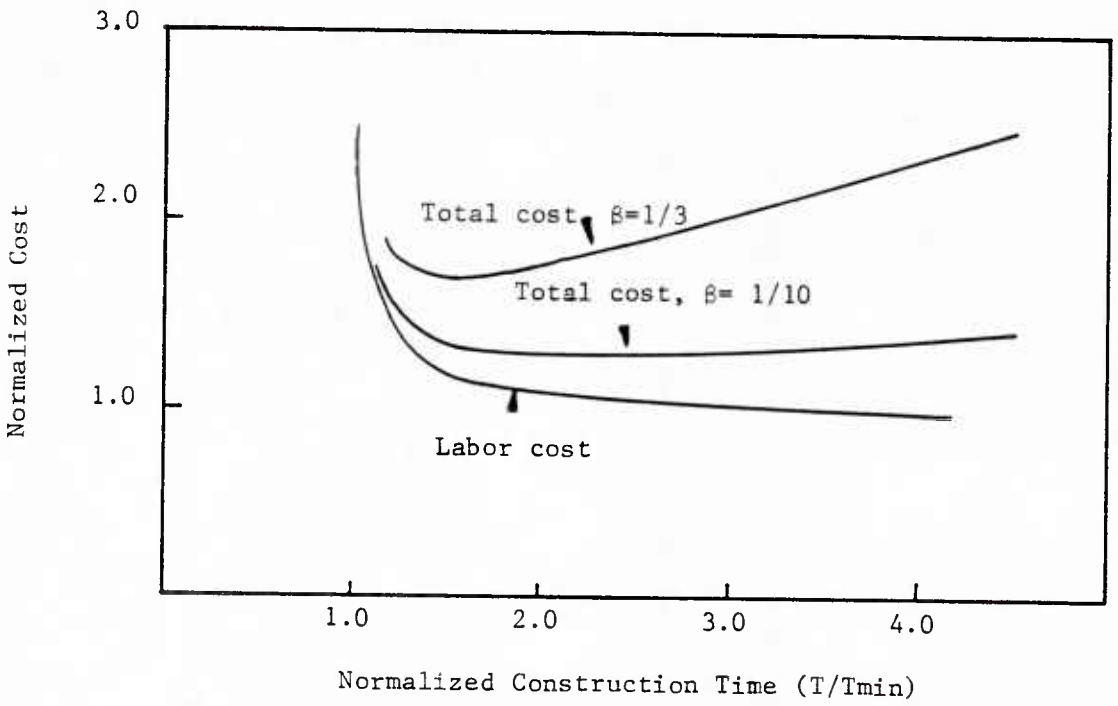

Figure 1. Normalized Costs versus Construction Time.

Construction costs may also be computed as a function of workforce level to determine the effect of variable shipyard workload on costs. A procedure for using fixed overhead rate to determine the variation of cost with construction time or workforce level is given.

EXECUTIVE SUMMARY

TITLE: ALTERNATIVE FOR SHORTENING THE SYSTEMS ACQUISITION CYCLE: MILESTONE 0 TO DSARC II

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PURPOSE: To shorten the front end of the systems acquisition cycle by seeking alternatives to program initiation funding constraints, streamlining competitive source selection procedures, and otherwise improving the systems acquisition environment.

PROBLEM: The systems acquisition process is too long. Since World War II, the time to conceptualize design, test, build, and deploy major weapon systems has doubled. What use to take 5-7 years now requires 12-13 years to complete. Moreover, recent studies have determined the most significant increases have occurred in the front end of the acquisition cycle: program initiation through DSARC II. This period has increased from two years in 1950 to more than five years at present. This growing problem has been identified as the single biggest deficiency in the acquisition process. It must be reversed if the United States is to sustain a credible defense capability.

Technology turns over faster than we can complete the system acquisition cycle for a specific weapon. Consequently, a new weapon system is technologically obsolete before it is deployed. This growing increase in time also contributes to program cost growth and jeopardizes United States security in the face of Soviet technological and numerical achievements. For these reasons, one of the greatest challenges facing the acquisition community today is in finding alternatives which will reduce the acquisition time for a new system. This challenge is hightened by the advent of OMB Circular A-109.

Data: OMB Circular A-109, as the "renaissance" of major systems acquisition, was published to put discipline into the decision making process. As such, it was not specifically designed to save time. It has spawned an ordered framework for reconciling needs and deficiencies by way of mission area analysis, development of a mission element need statement (MENS), and a new Milestone 0 decision added to the DSARC process. The debate over whether A-109 adds time to the acquisition process by the events leading to approval of the MENS (Milestone 0) is not the concern of this study.

Rather, it is the events after the Milestone 0 decision which can be exploited to shorten the acquisition process.

A-109 stresses the use of competition through each acquisition phase up to DSARC II. This equates to three multiple award and consecutive competitive source selections; each source selection requiring a year to plan and execute. Although there is some overlap with sequencial events, there is still a three year level of effort required to generate planning and approval documents to support source selection. The same people preparing for new follow-on phases are the same people that are supposably managing the current program. This situation also applies to the contractors. Simply, program management and source selection activities do not occur simultaneously without some penalty. That penalty is either a protracted program schedule, ineffective program management, cost growth, or a combination of all of these.

In order to accommodate the essence of competition embodied in OMB Circular A-109, existing procedures can be simplified, streamlined, or combined without any loss of control or change in statutory responsibility. Beginning with Milestone 0, three areas offer lucrative alternatives for shortening the acquisition cycle; initial program funding, source selection procedures, and enhancing the effectiveness of the acquisition community.

Recommendations:

FUNDING

Funding new programs should be obtained through the PPBS beginning with DSARC I (demonstration and validation). Prior to DSARC I, funding alternatives to the PPBS need to be exclusively developed for program initiation. Either establish a DOD contingency fund ($10 million each year) or encourage a new approach allowing the use of independent research and development funds. In any case, funds should be available at Milestone 0. This offers a potential to begin a new program as soon as the request for proposal is prepared. Unless there is an alternative to funding new starts through the PPBS, new programs will experience a built-in 14 month delay.

SOURCE SELECTION PROCEDURES

The framework of the source selection process is adequate as presently constituted. Some procedures within that framework should be modified, however. First, a source selection authority should be appointed concurrent with the SECDEF Milestone 0 decision. This would establish a source selection organization at the earliest possible date thereby

stimulating planning earlier in the process. Second, the requirement for source selection plans should be deleted. This document is redundant to other planning activities such as the acquisition plan, request for proposal, and source selection guide. Its purpose, to obtain delegation of source selection authority, can be accomplished in a more efficient way. Third, waive the requirement for a secretarial Determination and Findings; provided the program initiation phase is competed. Fourth, standardize RFP packages for program initiation efforts. This will reduce the "how to do it" controversy when dealing with the potential for multiple contract awards and competitive follow-on phases. It will also reduce RFP preparation time and overall workload. Fifth, publish a standardized operations guide for source selection organizations. Sixth, reduce command and control problems of source selection organizations by reducing lines of communications. Further, eliminate the source selection advisory council as a line function of the source selection organization. Seventh, as a matter of policy, do not appoint program managers or establish a new SPO until late in the program initiation phase. Instead, this phase should be initiated by laboratories or by a matrix project office within an existing SPO. These actions, if properly followed, could reduce the acquisition process by as much as 18 months. Finally, a major initiative orchestrated at the DOD or OMB level might be designed to seek out and eliminate or combine other events and processes not essential to effective management control.

INDIRECT IMPROVEMENTS

The products and operating procedures required to operate through the entire systems acquisition process are not understood by enough people. This deficiency causes the system to break down while learning and training occur by doing. Newly assigned people, because of personnel policies and shortages, are totally unprepared for this business. The few who understand the system are burdened by the task of accomplishing all the specialized work themselves. Time does not permit them to tutor others in the working environment. Therefore, training should be upgraded, made more intense, and more stringent training (not academic) prerequisits must be required prior to assignment in the program office.

Better management information systems need to be placed at the program office level. Automated office equipment, including "smart" typewriters and word processing systems should be installed at every buying agency. Modern office equipment if properly used can reduce a competitive source selection by three weeks.

Conclusion: There are no magic answers which will reveal the key to shortening the acquisition process. But, the process can be shortened by simplifying what has already been created. As a start, the recommendations offered in this paper are the kinds of things which will bring the greatest payoff in minimum time. However, change will not occur without a commitment. Indeed, even OMB Circular A-109 will not work unless a genuine sense of urgency is brought to bear on the people that operate and control the systems acquisition process. There is no point in streamlining the process if at the same time the decision makers require more time.

Finally, OMB and DOD policy and decision makers must jointly propose a combined initiative directed at the acquisition time problem. Otherwise, subordinate units are powerless to make any meaningfull contribution toward shortening the cycle.

EXECUTIVE SUMMARY

THE INCREASING EMPHASIS ON READINESS IN ACQUISITION

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Over the past five years, the importance of initial support investment and operating and support (O&S) costs have been of growing concern to management. Initially this concern resulted in attempts to improve weapon system O&S cost measurement and prediction. More recently this concern has been expanded to include a notion called "system readiness." The term is not directly associated with various current and well-known readiness issues, but is intended to denote measures of merit pertinent to the peacetime availability and wartime employment of a system. The specific measures may vary by type of system. To illustrate this, consider three examples.

	SYSTEM	MISSION	MEASURE
1.	Navy VSTOL Aircraft (singly deployed; isolated ships)	React to submarine detections	Operational Availability
2.	Army Radar Patrol	Maintain Continuous Coverage	Percent Coverage Per Day
3.	Air Force EW Aircraft	Escort Attack Aircraft	Sortie Rates Per Day

A major MRA&L thrust in the DSARC has been to model the probable "system readiness" rates to be achieved given predicted or demonstrated design parameters, such as reliability and maintainability (R&M), planned support resources, such as spares, and pertinent logistic system measures, such as resupply time.

The major difficulties with this approach involve availability of definitions, and data inputs, the large size of models useful for this purpose, and the validity of the models themselves. The approach taken to resolve the first two of these issues is use of simplified models which permit more rapid analysis and greater use of sensitivity testing, combined with real world data such as DT/OT testing results. Model validation will be addressed later.

As a generalization of the approach, most programs can be analyzed using one or two models. The first model is a spares model which optimizes Operational Availability achievable for a given spares budget, given various inputs such as LRU or WRA reliability levels, average resupply time and the expected Not Operationally Ready - Maintenance (NORM) rate. If Operational Availability

is the desired output measure this model is sufficient for testing a wide variety of sensitivities. If Operational Availability levels or an optimized spares budget is an interim step to a wartime output measure such as sortie rate/day, a second model is needed.

An example of the second model is a simplified simulation model which "flies" missions, given the optimized spares list, thus simulating maintenance, spares and manpower demands, and the resulting sortie rate achievable. This model can again be ran to test a wide range of sensitivities. Simplification is achieved by concentrating on the key subsystem likely to affect results.

Our plan has been to select some "lead" system for such in-depth analysis and work with the services involved to test this approach. Experience with the use of such models to support DSARC reviews has shown them to be valuable for assessing the impact of R&M and manpower and support resource deficiencies in terms of system readiness so that corrective measures can be taken before the system is fielded. In the case of a Navy ASW helicopter, where operational availability is an appropriate output measure, a number of issues, including a potentially serious sparing problem were identified. Actions are underway to address these issues. In the case of an Army radar patrol aircraft, opportunities to achieve a high rate of coverage during a 72 hour surge (e.g., one of four division aircraft airborne at all times) while reducing investment costs were identified. These involve use of three aircraft plus WRSK kit approach in lieu of four aircraft, and repair of radar LRUs at I level only instead of "I" and "O" level. These opportunities are under investigation by the Army.

The third case involved an Air Force EW aircraft. Here the appropriate output measure is sorties per day for surge and sustained conditions, since other aircraft may not fly if an EW aircraft is unavailable. The analysis indicated that surge and sustained goals would not be met unless fixes for deficiencies identified in DT are effective. It also showed that additional spares would not improve sortie rates unless manpower bottlenecks were first eliminated. Additional testing and analysis is now planned by the Air Force.

These initial results indicate that the "readiness" approach is very promising. Applications of the concept to some missiles and ground vehicles, as well as aircraft, is underway. A key and open issue is model validity. While the models used in the examples have been validated to the degree possible, frequently against larger, more complex models, more needs to be done. In the long run, given greater stiumlus in this area, one might well say with confidence that better models, if needed, will be developed.

The "readiness" approach provides an output measure for support issues in lieu of the past management "gut feel." Assuming that this approach is solidified and adopted by the service, the long range impact will be much more explicit consideration of readiness measures and related manpower and support both in program management and higher level management reviews.

PRICE — TAILORED COST ESTIMATING WITH A UNIVERSAL MODEL

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PRICE, a computerized parametric technique used widely in government and industry, is unique in its tailored universal approach to realistic cost estimating. PRICE considers the influences of the facilities, skills, experiences, and resources to be applied, as well as provisions for economic and technological changes and advancements. Innovative procedures enable efficient project description for a virtually infinite variety of products with a small set of key cost drivers, and permit calibration and tailoring to individual organizations and product lines.

EXTENSIVE USER BENEFITS RESULT FROM 20 YEARS OF CONTINUOUS DEVELOPMENT

PRICE is a family of parametric Cost Predicting Models, the outgrowth of more than 20 years of operations research in cost modeling. It generates appropriate regressions of CERs (cost-estimating relationships) for a range of systems or products. In essence, it performs a multi-dimensional extrapolation of past experience to predict cost. The basic PRICE hardware model predicts development and production costs for proposed electronic, mechanical and electromechanical systems and devices while still in the concept stage. PRICE L—the life cycle cost model—operates in conjunction with the basic model to rapidly compute support costs for many varieties of systems. PRICE S—the software model—estimates computer software costs for the complete range of systems and applications programming.

Easy to use. Cost predictions are obtained with ease and speed. The trained PRICE user gathers data about a proposed product by asking a few simple questions of the engineers planning the equipment, and records the data on PRICE input forms. He enters the PRICE data into the time-shared computer in which the PRICE model resides, and within minutes the terminal prints the output, giving the development, production, and total costs for each equipment, including the costs of integrating and testing as a complete system. Provisions are made to rapidly modify or correct any or all of the inputs and just as rapidly see the effects of these changes on costs. *A multimillion dollar system can be thoroughly costed in as little as two hours.*

Insensitive to missing data. Since the PRICE model predicts from a "macro-" or top-down approach, it is relatively insensitive to missing input data. PRICE heuristically generates missing information based on the profile of the input data. Obviously, the more known about the physical characteristics of the end product, and the more basic descriptors that are supplied, the more precisely PRICE can predict costs. But because the model uses descriptors such as weight, volume, technology, percentage of existing designs, and the planned engineering and production schedules, unknown factors can be omitted and the model will calculate them.

Tunable to the application. When the PRICE model is calibrated with empirical values that represent an organization's way of doing business and their product line, the PRICE estimates become a reflection of the history of that organization and provide an indication of how the organization will perform on the new project.

Effective in all stages of a program. PRICE is effective throughout the various stages in the evolution of an equipment or system, and particularly in early configuration tradeoffs. Alternate configurations can be entered and virtually instant economic impact assessments made. Highly sophisticated and costly technical approaches can be quickly identified, and modified to more cost-effective approaches. And since PRICE can be operated with a minimum of inputs, the manpower to generate early estimates is significantly reduced.

Rapid and cost-effective in processing. Availability on commercial time-sharing systems permits evaluation of design and management alternatives with turnaround times less than five minutes. This rapid turnaround makes possible the thorough analysis of alternatives which otherwise would be unaddressed because of lack of time or talent. And because of its efficiency in focusing on the significant cost factors, the cost for processing PRICE is always a small fraction of the cost of more traditional estimating methods.

Substantiated in accuracy and reliability. Because of the rigor of its algorithms and structure, PRICE has proven many times to be more accurate in forecasting a system's costs than the technologists who have proposed or evolved the new system. The accuracy and reliability of the models have been substantiated by testing against known costs of completed projects in more than 50 organizations and government agencies. Most of the estimates were within 10% of actual costs, and a substantial number were within 5%.

Self-Checking. In addition to cost and schedule outputs, PRICE generates key parametric values which amplify the product's characteristics and the scope of work being measured. These values are used to confirm the credibility of the PRICE output.

PRICE IS UNIQUE IN ITS PROCESS ORIENTATION

Conventional CER models are data-based limited. The customary approach in developing classical CERs is first to gather as much relevant data as possible, then screen the data for consistency, reduce the data by formal statistical procedures, and present the results in the form of one or more CERs. The classical approach enables investigators to test hypotheses and identify significant factors that have affected past developments. But this approach used alone is data base limited. It does not extrapolate well when applied as a cost estimating procedure to new situations and simply cannot account for all factors that drive costs.

PRICE is process-oriented. Like the classical approach, PRICE enables investigators to test hypotheses and identify significant factors affecting past developments. But while consistent with classical results, PRICE doesn't use these results as an end in themselves. PRICE blends them with quantifications of perceptions of experienced people. PRICE is able to do this because it is process oriented rather than data base oriented. The PRICE model emulates the processes by which experienced managers, engineers and cost estimators assess the impacts of key cost and schedule drivers.

PRICE tunes to the most relevant data base. PRICE does not depend on a single CER or on a single data base. By focusing on the *process* of rational cost estimation, it preserves for the user the flexibility to tune the model to the particular data base most relevant to the estimate in question. Normally, cost histories of previous projects within the user's own organization or product line will provide the best reference. Experience shows that within-group scatter of these data is much less than the across-industry scatter present in classical CER approaches. The net effect is that the central data base in each case is the user's. The calibrating procedure ensures that special factors present in the user's development environment are included. New project descriptors can then be evaluated in light of accumulated industry-wide experience, scaled to the user's own data base. There is no single cost equation. In practice, PRICE develops a new family of CERs to fit each specific application.

EXECUTIVE SUMMARY

PROGRAM MANAGER INTERVENTION: BUFFERING THE DYSFUNCTIONAL EFFECT OF INCREASING ACQUISITION COMPLEXITY ON PRODUCTIVITY

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SUMMARY

The management of the acquisition process increases in complexity as the cycle develops from needs assessment to final disposal. In the initial stages, the acquisition organization is a simple organization and the management process involves the planning, organizing, and structuring of the tasks that must be performed.

As the cycle develops, the structuring of the work becomes more complex as the problems of coordination and control increase. The complexity of the process begins to contribute to frustration, confusion and poor motivation on the part of individual team members. It also contributes to lack of cooperation and mistrust among team members and between team members and the project manager. The increase is dysfunctional behaviors i.e., frustration, confusion, low morale, poor cooperation and mistrust ultimately results in observable measures of increased turnover, absenteeism, sickness, and lowered quantity and quality of productivity.

Two strategies are available to the program manager for adapting to or mediating the dysfunctions of the increasing complexity of the acquisition process. One strategy involves designing the structure of the managerial system to mediate the increased behavioral problems. It is not always possible to pursue this strategy, however, if the organization in question is subject to a rigid set of restrictions as to authority structure, reward systems and communication networks. In this case, the program manager must resort to an intervention strategy to offset the inherent dysfunctions of the process.

The use of leadership intervention as a mediating strategy requires that the program manager be continually involved in the process. It also requires matching managerial styles of program managers with the requirement of the acquisition process. In this approach, the dysfunctions of the acquisition process are considered to be parameters. The program manager's leadership style is seen as the mechanism for dealing with or buffering the parameters of acquisition complexity.

Several aspects of leadership behavior have been conceptualized and measured (Stogdill, et. al.). These include the behaviors of: representation, motivation, participation, interaction, direction, rule orientation and goal orientation. This paper reports the effectiveness of each of these leader behaviors as a buffering mechanism to offset the behavioral dysfunctions of increasing complexity.

Research Findings

The importance of direct leadership intervention as a technique for offsetting the dysfunctions of increasing complexity has been demonstrated in the private sector. Organizations representing a cross-section of industries including manufacturing, utilities, hospitals and service organizations were sampled. In all approximately 900 individuals, 80 groups and 40 different firms were involved.

Multiple regression analysis was used to test the significance and direction of the mediating effect of leadership on organizational complexity. The mediating effect was tested on three levels of behavior in organizations; individual motivation, group cooperation and trust, and leader-member relations as measured by cooperation and trust between supervisors and subordinates.

First, the significance of the mediating effect of leadership, as measured by aggregating all the leader behaviors, was tested. Leadership was found to have a significant interaction effect for all three behaviors examined; individual, group and leader-member. Second, the significance of each of the leader behaviors as a mediating variable was tested. Representation was found to be the most important mediating leader behavior. It was highly significant for all three types of behaviors. The findings indicate that the more the manager represents the interests of his workers and the work group, the better the buffering effect. Findings also indicated that a high degree of goal orientation and participation also mediated the negative effects of organizational complexity but to a lesser extent than representation. A high emphasis on standards by the leader was found to increase rather than offset the negative effect of organizational complexity.

Significance

These findings have important implications for the management of the acquisition process. As the cycle develops and the process becomes more complex, the program manager can mediate the negative effect of this complexity by adapting a more representative style of management, becoming more goal oriented and involving team members in the decision process. Since military operations are organizations which are inherently structured with little flexibility in terms of authority structure, reward systems or communication requirements, the use of the managerial style as a buffering agent is crucial to the effectiveness of the acquisition process. These findings can be directly applied to improving acquisition productivity.

EXECUTIVE SUMMARY

AN ANALYSIS AND EVALUATION OF ECONOMICS IN AIRCRAFT ENGINE REPAIR-DISCARD DECISIONS

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Shortages of materials which are processed from strategic natural resources have resulted in significant price increases for many processed products. Documented evidence shows that these shortage related price increases have created a high cost situation for the Air Force and DOD in terms of new acquisitions and maintainability of current assets which contain significant amounts of shortage type materials. According to economic theory these price increases should result in an alteration of current consumption patterns and require more and more recycling of current asset materials. The overall objective of this study was to examine and evaluate selected aspects of the aircraft engine repair-discard process to determine whether recycling is at the optimal economic level.

The expendability, recoverability, and repairability category (ERRC) coding for aircraft engine components and accessories designates the methodology to be employed in computing material requirements, designates disposition when the item is no longer economically repairable, and are used in reporting of asset and supply usage data. Based on a comprehensive review of the ERRC codes system for aircraft engines as used at the Oklahoma City Air Logistics Center, ERRC codes are changed only: 1) in response to a significiant change in lead time for specific components (but only after the increased lead time creates a problem); 2) when the contractor is unable to provide components due to non-availability of resources; or 3) when the contractor develops a new product. Otherwise, item managers and equipment specialists continue to use the ERRC code which was established during initial provisioning. Consequently, level of repair/discard depends only on the cost of initial hardware procurement and availability requirements, without any consideration of current price increases. Although the D041 and D062 systems are designed to provide management data to help the item manager and equipment specialist make decisions on item requirements, current increasing costs are not an operational part of the system.

Although decisions by the item manager and equipment specialists are the heart of the ERRC coding process which establishes repair-discard procedures, other managers also have an impact on the process. As requirements are determined by the item manager and travel through channels, neither requirements-buy nor procurement personnel let increasing costs resulting from shortage of materials influence their decision process. Apparently, items are simply purchased at the going price as long as funds are available.

Our analysis and evaluation indicates that recycling of materials in engine maintenance procedures is probably below optimum because of deficiencies in consideration of current price increases. Subsequent to this analysis and evaluation, experts assigned to PRAM, ASD-RAOF, WPAFB completed a survey of nearly 1,000 selected expendable end items which were identified as potential candidates for ERRC code changes that could result in significant monetary savings. These expendable items were on three weapon systems-the FB-111, the KC-135 and the F-4.

ERRC code changes were suggested for 172 of these 1,000 items. At the present time changes have been initiated on 52 items with a tentative projection in annual savings of $919,000. Six of the 52 items at a projected savings of $93,000 were on the FB-111 weapon system, 18 of the 52 at a projected savings of $202 were on the KC-135 system, and the other 28 at a projected savings of $516,000 were on the F-4 system.

The engine repair-discard evaluation with support of the PRAM survey substantiates the hypothesis that significant monetary cost-saving opportunities exist for selected ERRC code changes. Current review procedures are inneffective and should be replaced by a systematic cost-saving review procedure which incorporates a consideration of current price increases.

Several techniques which could be used to incorporate these price increases into the decision framework already exist. Inclusion of these resource related costs would aid management in eliminating many future cost problems and prevent disruption of operational and safety objectives. At the same time, it would help satisfy Air Force and DOD's social responsibility in use of these shortage materials which are processed from strategic natural resources.

EXECUTIVE SUMMARY

MODELING THE ACQUISITION STRUCTURE AND PROCESS

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BACKGROUND

The policies governing the acquisition process have been under continuous review and revision. Acquisition policy has shifted from fixed price contract emphasis to cost plus soon after the Korean conflict, to multi-year and total package procurements in the late 60's, to variations on combinations of cost-type and fixed price contracts. In the last decade, further policies and experiments have been tried. These include prototyping at the R & D stage, and a variety of approaches at the production stage including second sourcing, leader-follower procurement, and separation of acquisition process into stages with technology licensing and breakouts. Attempts to bring escalating costs under control have resulted in the design to cost emphasis in 1971. OMB Circular A-109 is another step in experimenting with policy approaches. The policies have emerged over time as new goals have been formulated, better understanding of issues developed and as a reaction to emerging problems--cost overruns, technological obsolescence, escalating costs of systems, over or under design of systems, systems that have low initial costs but unanticipated high life cycle costs and similar complex issues.

SUMMARY

One factor contributing to the difficulty of formulating policies that deal with these problems is that the acquisition process has been only partially understood and modeled. The acquisition process can be viewed as a set of transactions between the buyer(s) and the seller(s) in a particular type of market environment. These conditions support or impede arriving at a stable set of transactions. A simple type of exchange and a permissive environment creates stable conditions; a complex exchange and demanding environment requires adaptability and innovation in acquisition policies.

As the buyer and seller formulate their strategies, the rules for the transaction emerge. The seller formulates strategies and policies that are designed to adapt to, or influence the nature of the environment within which it operates. Likewise, the buyer formulates policies and strategies to influence, or adapt to the nature of the environment within which it operates that will best promote its goals. Together, they exert influence over each other to define both the rules governing the interaction and the terms of exchange.

The problems of policy formulation are complicated by the interdependent nature of the decisions. The business firms must consider the reactions of competing firms to their strategies as well as the probable reaction of the potential buyer. The strategies of the governmental departments in defining the rules of the game for suppliers (such as nature of incentives provided, emphasis upon

using existing technology, extending or devising new technology, or emphasis upon initial costs or life cycle costs) are formulated with some assumed reaction on the part of suppliers. The suppliers must either adapt to these constraints as specified, seek revision in them, or seek modification in their implementation if they are to do business with the government agencies.

The problem is further complicated by the short- and long-term impact of the policies. The sellers often formulate policy that is designed to improve short-term effectiveness measures. Often, this approach has the unintentional impact of undermining continuity of the transaction and require policies to be revised when the implications are realized. Similarly, the governmental departments design policies to solve particular problems. Often the solution of one set of problems contributes to even greater long-term problems such as when initial costs are minimized and life cycle costs are sharply increased; or when the level of costs is reduced and predictability of costs is increased, but this is at the expense of technological obsolescence. Short-term solutions may create greater problems over time that require higher risks, greater expenditures, and loss of credibility of those involved.

This paper develops an acquisition model which is partially depicted in Figure 1. The model identifies two sets of outcomes--degree of goal attainment, and degree of support from funding groups (congress and the executive body) and the public media. These outcomes are shaped by four sets of factors--the type of exchange, the nature of the environment within which the buyer and seller operates, the policies formulated by the parties that define the rules for the exchange and the nature of the transaction process. These properties are posed in variable terms, and the relationships developed by systematically stating the way in which variations in the environment, nature of exchange, type of policies, and character of transaction process affect attainment of multiple goals of the buyer and seller and climate of support of relevant groups.

A second aspect identified is the degree of interdependence among the environmental factors, the transaction process and the outcomes from the process. It is a useful analytical simplification to examine one way effects with the environment influencing buyer and seller policies, and these shaping the transaction process which, in turn, determine outcomes. The next level of analysis is to examine the degree of interdependent influence these factors exert over each other and the movement to equilibrium or disequilibrium through time.

SIGNIFICANCE

Making a model explicit enables systematic evaluation of whether important variables and relationships have been identified; a model also supports systematic ordering of past and present work, and identifies more clearly the areas where additional work is needed. For example, modeling makes explicit tradeoffs and the conditions that determine which alternative will best promote organizational goals. A better basis is created for evaluating whether present policies promote the goals of the governmental unit. While much of the thrust of the defense department and others considering practical problems is on the means to implement existing policy, a model provides a better perspective on whether the present or proposed policies will serve the government even if they are implemented skillfully and completely. A model shifts the focus of attention from implementation of policy to formulation and evaluation of policy.

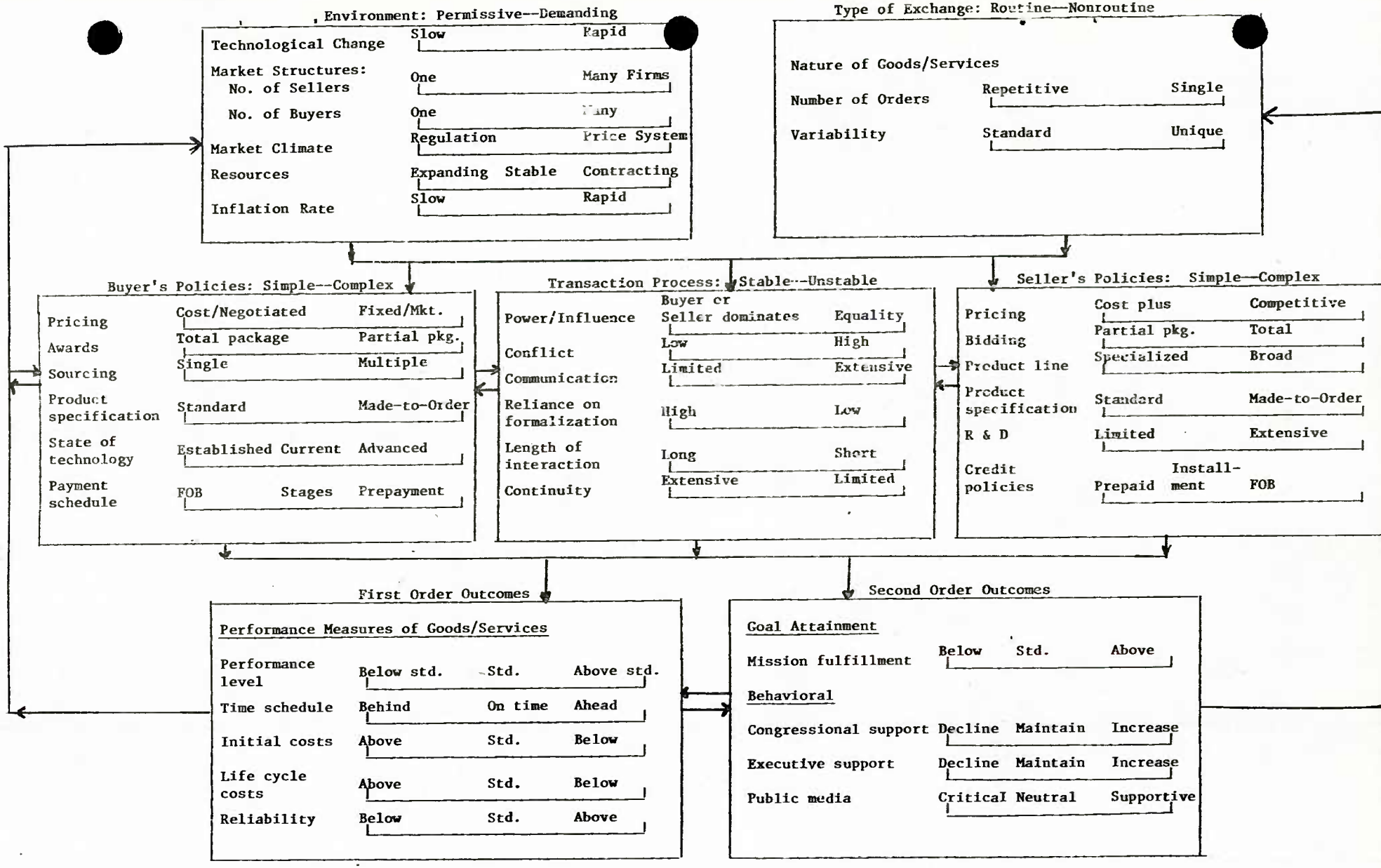

Figure 1

Partial Model of the Acquisition Process: The Environment, Type of Exchange, Buyer's and Seller's Policies, Transaction Process, and First and Second Order Outcomes

EXECUTIVE SUMMARY

OMB CIRCULAR A-109 IMPACT ON NEW DEVELOPMENT AND LEVELING EFFECT

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OBM Circular A-109 is potentially the most important acquisition document ever published, according to Lester A. Fettig, Administration for Office of Federal Procurement Policy (Reference 1). However, A-109 did not suddenly appear as result of any one action of government or industry. Improvement of the acquisition process in DOD started back in the McNarmara-Hitch era and was further modified during the Laird-Packard period. Where as McNarmara-Hitch placed considerable emphasis on systems analysis, Laird-Packard placed emphasis on the people, the managers of programs, and product testing; e.g., Packard's "fly-before-buy" concept.

A-109 incorporated the twelve recommendations of the Commission on Government Procurement, although many of these recommendations were already in effect in DOD, having evolved over a decade or so and been promulgated through DOD Directives 5000.1 and 5000.2. A-109 has a primary impact on the "front-end" of the acquisition process through the requirement for mission analyses and the evaluation and exploration of alternatives to meet Agency mission need(s). The additonal requirement for a Mission Element Need Statement (MENS) to be presented for approval at the new DSARC 0 establishes program initiation and is the basis for exploring alternative solutions.

The exploring of alternate solutions, with industry's help, and the building of a technological base "inhouse," within the government, is where the transfusion among competing contractors' ideas is prevalent and the attendent so called technical leveling takes place. The government's use of competitive concept formulation to become a "smart buyer" could meet with some resistance from the industrial side when it seems apparent to the contractors that their best ideas, developed with IR&D funds, will re-appear in an RFP for them to propose and bid to. There has to be a certain amount of auctioning and second guessing the government program office on the part of the contractors in order to get into the "ball game." The mixing together of preconceived ideas of what the system, subsystems or improvement should be with the cross pollination of the various alternatives during the concept phase is difficult to guard against. It drives the contractors to hold back on new ideas and attempt to influence the selection process through brochuremanship in order to keep from expending too much IR&D funds until there is some assurance that the contractor is at least in the running.

There is a desirable user "pulling effect" based on the mission need as described in the MENS. However, there is a counter "pushing effect" based on the assignment of a program manager and staff at program initiation; i.e., milestone 0. The program manager's first task is to develop an acquisition strategy tailored to meet the mission need in an economical, effective, and efficient manner. The program manager must keep the program going and guard against

organizational entropy. The cure for this might be the review of the MENS and updating or rewriting the Development Concept Paper (DCP) at each DSARC/Milestone in order to keep the program directed toward the goal of fulfilling the mission need or terminating the effort, as appropriate.

Besides the requirement that there be effective early planning to coincide with the emphasis on the "front-end" imposed by OMB A-109 and DODD 5000.1 and 5000.2, there is need for a new and better communications process among the Program Office, the in-house laboratories, and industry. The government visits to contractor plants, either informal or as in-process reviews, can place the government managers and engineers in the position of being the source of technical leveling. Although the Four-Step Procurement process is not addressed as part of this paper, it should be considered suspect in contributing further to this effect. The government must communicate the requirements to industry, industry must respond to these requirements, and government must evaluate and select alternatives and contractor(s) without compromising the IR&D effort. Also, preconceived notions for solutions to mission need should not be forced before gaining a true appreciation of the possible alternatives.

References:

(1) Statement of Honorable Lester A. Fettig, Adminstrator for Federal Procurement Policy Office of Management and Budget, before the Subcommittee on Research and Development House Committee on Armed Services; November 2, 1977.

EXECUTIVE SUMMARY

A SYSTEMATIC APPROACH TO ACQUISITION PLANNING FOR CONTRACTING

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Today's acquisition philosophy in the federal government starts with OMB Circular A-109, "Major Systems Acquisition," which stresses that any new mission need should be satisfied by a system selected on the basis of a rigorous screening process from a group of alternative systems. Requirements should be stated in broad performance terms rather than in terms of some specific type of equipment. The decision on which system to carry forward to meet the mission need will be made after a series of studies and demonstration and validation contracts.

The leading Army acquisition regulation (AR 1000-1, Basic Policies for System Acquisition by the Department of the Army) lists four major alternative system approaches that might satisfy a mission need: Product improvement of current standard equipment (the preferred alternative), nondevelopmental equipment (domestic, foreign, other service), modified nondevelopmental equipment, and development of new equipment.

After selection of one of these systems, more thorough planning can be made in acquisition and contracting. It is submitted in this paper that factors in planning at this point are: the objectives of the acquisition, the relevant conditions under which the acquisition is being made, the possible strategies that might be employed, and the tactics that might be used to augment or supplement strategies.

Acquisitions vary in what they try to do. Although it is true that ultimately for each acquisition the government wants a system or item that meets performance requirements in some desirable time at some acceptable price, usually a particular acquisition will have specific prioritized variations of performance, time, and cost objectives. Acquisition managers must therefore put priorities on their objectives from top to bottom in order to be able to know what decisions are to be made in trading off performance, cost, and schedule parameters and in order to be able to select proper strategy and tactics.

In addition to the acquisition objectives managers must evaluate the conditions under which the acquisition is taking place before detailed planning can be done. Some structure is needed, however, to be able to sort out all the relevant conditions. One natural grouping of conditions for evaluating an acquisition is as follows: (1) The system (e.g., technical risk), (2) System Requirements (e.g., money constraint), (3) Government resources (e.g., experience of staff), (4) The marketplace (e.g., number of capable firms), and (5) External conditions (e.g., congressional pressure).

Once the acquisition manager has decided what he wants to do (the objectives) in the acquisition, and the conditions under which he must operate, then specific plans on how to do the acquisition can be made. The names for these plans vary throughout the government and DOD, but one term seems to prevail in some form or another in most agencies -- strategy. It is recommended here that the acquisition strategy be defined as the overall phased plan for accomplishing the acquisition objectives. The strategy would be composed of general plans for each aspect of acquisition: financing, contracting, testing, etc. In line with the use of strategy, the term tactical planning is recommended for those detailed plans that implement strategy.

An example of strategic and tactical planning can be seen in planning for contracting (for a developmental item). Strategic plans might be grouped logically as competitive or noncompetitive. A competitive strategy might include a competitive runoff in advanced development to select two proposals to carry forward for competitive prototypes in engineering development to result in the first production award going to the winning prototype and with plans for competition in later production runs. The tactical plan would support this strategy and would plan for the contract type for each phase, special pricing arrangements, other contract provisions (e.g., design to cost, breakout program, VE, etc.), and relevant extra-contractoral techniques (e.g., suggested organizational structure for the contractor, configuration management coordination, active pursuit of contractors for competition).

How does an acquisition manager analyze his objectives and relevant conditions in order to make strategic and tactical planning? Each agency should collect empirical evidence on its individual procurements and identify what strategy and tactics work under what conditions and for what objectives. This is valuable information and should be collected and analyzed. Agencies should also attempt to find the experience of other organizations to broaden their data base.

When an acquisition manager gets a new acquisition, he first must painstakingly prioritize his objectives and define the conditions of the acquisition. Then he must review the data base of his affiliated agency and of any other he can find, as well as any available acquisition literature, in order to seek the set of strategies and tactics that worked well for similar objectives and conditions. The acquisition manager and his staff must then analyze this experience of the acquisition community, add their own ideas, and match the proper plan with their acquisition.

Ultimately it might be useful for the service or government agency to formalize this approach into a planning guide, not a "cookbook," to help acquisition managers make plans for their acquisitions. Nonetheless, by whatever method, the process of a rigorous review of acquisition objectives, relevant conditions of the acquisition, acquisition strategy experience and acquisition tactics experience must be accomplished in order to do this planning. This paper has suggested one approach for doing so.

EXECUTIVE SUMMARY

PLANNING FOR NAVY SHIP ACQUISITION

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The Analytic Sciences Corporation (TASC), under contract to the Office of Naval Research, has performed a preliminary analysis of the cost and feasibility of achieving a more efficient workload distribution in the shipbuilding industry through competitive allocation. This analysis has considered the feasibility for the development of an analytic tool which would permit achievement of an efficient workload distribution in the shipbuilding industry. This analytic tool models the interaction between the shipbuilding industry and the Navy. It is anticipated that the use of a computer model will permit consideration of efficient labor utilization in the shipbuilding industry and its interaction with the Navy's budgeting, force acquisition planning, and procurement processes. It will provide decision makers with a tool permitting them to test for the predicted results of different shipbuilding decisions thereby permitting consideration of a greater range of options.

TASC has determined that a computer based modeling approach is feasible, and its use would be expected to significantly improve the Navy's long-range planning for shipbuilding and provide specific guidance in its acquisition policy on a year-to-year and ship-to-ship basis with an objective of improved resource allocation. This paper, which presents the results of a six month study, demonstrates the feasibility of such an analytic approach. TASC is currently pursuing the follow-on to this study, which will lead to the further development of this computer model.

For the present study, "competitive allocation" is defined as the allocation among shipyards of a Five Year Plan with appropriate uses of the price benefits of competition and the stability benefits of allocation to result in a shipbuilding program which costs the Navy the least, given other objectives and constraints such as suitable quality of products, attainment of schedules, and maintenance of industry capacity.

To demonstrate the feasibility of modeling competitive allocation, a preliminary model was designed. This model is based on the comparative efficiencies of individual shipyards and on their behavior in the marketplace. When fully developed, it will be a tool to inform the Navy of:

- The desired competitive allocation for Five Year and longer-term Plans
  - which distribution of work among yards costs the Navy the least?
- The acquisition methods needed to implement the competitive allocation

- which yards are appropriate participants in competitions staged by the Navy?

- which yards are appropriate candidates for allocations of ships?

- on which programs is a combination of allocation and competition most appropriate? (e.g., requiring two yards to be used)

Previous studies and interviews with people associated with the shipbuilding industry revealed that, while there is much agreement on the factors which affect the costs and delivery items of ships such as employment level and stability, and quality of labor, the interrelationships between these factors and relative magnitudes of their impacts are not explicitly defined. Thus, the model was developed so that historical data would test the magnitude of each factor's impact and the functional interrelationships of the factors.

The basic modeling approach uses three modules. The first module is the estimation of the relative cost of production in different yards. The second uses these relative costs, and information on the market strategies of the yards, to estimate prices and price sensitivity of the Five Year Plan which costs the Navy the least. The third is an executive module which controls the program, incorporates competitive effects and Navy decision criteria, and makes the least cost allocation.

The cost estimation part of the model is an adjustment of the Navy's estimate of the basic cost to build a ship, as it would vary with individual yards. The specific variables, such as labor quality and supervisory experience, were revealed by interviews and previous studies. The model was designed so that the weight of each factor will be determined by historical data.

The price estimation module is based on the yards' relative costs, as revealed by the cost estimation; on the price benefits of competition; on the objectives, needs, and constraints of the Navy; and on the objectives of the yards and their gaming, or strategic behavior (as revealed by interviews, annual reports, etc.). These aspects will be combined to find the allocation of work which will cost the Navy the least, and to show which yards are appropriate candidates for competitions for ships, and which yards are appropriate candidates for allocations of ships.

EXECUTIVE SUMMARY

ACQUISITION REVIEW - A HELP OR A HINDRANCE?

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The acquisition process has embedded within it many types of review at all levels. From the basic engineering conferences to congressional committee testimony, all project managers are beset with these many reviews. A natural and obvious question often asked by project managers as well as reviewers is that of "Are all of these briefings and reviews really necessary?". A companion question often asked by both reviewee and reviewer is "What do we hope to accomplish with these reviews?". One such review is conducted by the Chief of Naval Material and is simply termed the Chief of Naval Material Acquisition Review Board (ARB).

During the conduct of the ARB over the preceding 18 months, over 100 major acquisition programs have been reviewed. These reviews have been conducted to provide the Naval Material Command corporate management with the specific and detailed program information necessary to formulate the corporate position, to address specific program issues and problems, and to provide a periodic management overview across a broad mission need area. In addition to serving to inform corporate management, many factors related to major systems acquisition have been present for many of the programs reviewed. The minutes or proceedings from these sessions serve as the "lessons learned" documentation for these common problems. The following represent some of the program management areas which commonly befall Navy programs:

a. Insufficient management reserve in both time and dollars, particularly at the juncture engineering development turns to production.

b. Inadequate mission sponsor definition, insufficient financial resources for the defined mission requirement, or both.

c. Inconsistencies between program authority (documentation) and resources allocated (financial, management manpower).

d. Diverse or fractured project management structure.

e. Inability to adequately monitor cost and schedule.

f. Failure to reconcile external influencing factors.

g. Reluctance to seek external assistance necessary to resolve problems beyond the scope and charter of the individual Project Manager.

A properly structured program review which receives the support of both the program under review as well as the reviewing authority can serve as an advocate to the acquisition program and thereby serve as a help. Conversely, a poorly structured program review without the necessary support of both parties will surely serve in an adversary role and thereby prove to be a hindrance to the acquisition process. The "help" which a program receives comes in the form of management support within the development community as well as the requirements community to rectify and correct the deficiencies noted during the review. The "hindrance" to the acquisition process evolves from the absence of necessary management information or the misinterpretation of information provided out of the proper context.

It is essential that both the reviewee and the reviewer strive to provide the best program review possible. Without this dual effort, the following axiom commonly known as Cohen's law will persist:

"The more time I spend telling people about what it is I do, the less time I have to do what I am supposed to do. Stability is reached when I spend all of my time telling people about the nothing I am doing."

EXECUTIVE SUMMARY

TIMELY ACCESS TO DATA EARLY IN THE DOD ACQUISITION PROCESS

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THE PROBLEM

There is a need to obtain government thinking and information early in the acquisition process. In order to respond effectively to the operational deficiencies defined in the Mission Element Needs Statement (MENS), intelligence and technical data should be made available to all competitors involved in exploring alternative system design concepts.

Currently, adequate threat information which details the current and projected capabilities and limitations of U. S., NATO, and Soviet weapons is not made available sufficiently early in the program. A failure to identify and establish the threat characteristics at the outset of the program could contribute to industry's inability to respond properly to MENS requirements.

Lack of a common technological data base to draw information from, limits each company's ability to develop creative and responsive design concepts that will meet the established threat defined in the MENS. Lack of critical data results from previous studies could inhibit innovative solutions to the MENS, if not made available to contractors early on and in the level of detail required.

SCOPE OF THE REPORT

This study addresses the access to foreground data, which is data developed under government-funded contracts and is clearly Department of Defense property. Even though background data (data developed by industry funding) usually represents a key part of the overall data package, a separate situation of obtaining licensing and data rights through industry-to-industry negotiations exists. Access to background data raises questions on government legality in releasing proprietary data and in determining the amount of compensation required to release data resulting from a technical innovation. Even though this is a major issue, obtaining background data was considered as a separate problem outside of the scope of this report. The report is also limited to examining U. S. defense acquisitions and will not include NATO Family of Weapon System and Rationalization, Standardization, and Interoperability (R/S/I) procurements and the complications of multinational government and industrial data rights agreements.

Intelligence Data. Critical intelligence parameters, required to supplement the MENS with a defined threat, could be made available through a formal closed loop flow of intelligence data leading to access by all the industrial competitors. Dialogue would be initiated between the intelligence community and the acquisition community or program office to establish a draft Intelligence Interactive Analysis Report that would define and describe all the critical parameters. Feedback between these two groups would continue to ensure that all additional intelligence data is included to adequately define the threat. Upon approval of both the Program Manager and the Intelligence Officer assigned to the effort, a Preliminary Intelligence Interactive Analysis Report would be provided to all industrial competitors during pre-Request For Proposal (RFP) briefings. Under proper security supervision, industrial representatives would be given an equal opportunity to provide comments and questions back to the government. A Final Intelligence Interactive Analysis Report would be provided to industry as part of the classified portion of the RFP. This final report would have all the documented changes and additions resulting from discussions at the pre-RFP briefings. This closed loop system provides early access to intelligence information by all competitors and provides industry with an equal opportunity to have an early start at developing effective "design-to-threat" conceptual solutions. This final report would also serve as the baseline for updating the threat, if required later in the acquisition process.

Technology-Based Data. In addition to providing industry with the MENS and supplemental intelligence data as part of the systems design concepts RFP, industrial competitors should have equal opportunity to access technology-based data. This foreground technology-based data is available from studies generated by government laboratories, federally funded research and development centers, educational institutions, and other not-for-profit organizations. There are some established (but ineffective) procedures for acquiring these reports. Considering all the sources, it would be an arduous and time-consuming task for program office personnel to compile a list of all those reports that relate to the specific mission areas in their MENS.

A long-range approach would be for each DoD service to develop a data base that would be capable of linking technology-based data reports to a common service-wide list of mission element areas that would apply. Unique reference numbers would be assigned to all of these reports by relating the document back to the budget accounting data that identifies those specific funds expended in support of the effort. For example, with specific budget and mission area data as illustrated in Table 1, a unique reference number, such as 77-1-6XXXXN-YYY-AAAA, would be generated. The reference number would contain a document identifier field (e.g., AAAA) which would relate to a specific technology-based report. Each reference number field would be part of a record containing

the specific report's security classification and a point of contact for obtaining a copy of the report. A file of these records by reference number would be created, maintained and updated by each Service, with communication links to provide access among the Services.

Table 1. Sample Budget and Mission Area Data

FISCAL YEAR:	1977
BUDGET ACTIVITY:	1 (Technology Base)
PROGRAM ELEMENT:	6XXXXA (Army)
	6XXXXN (Navy)
	6XXXXF (Air Force)
RELATED DOD MISSION AREAS:	YYY
	ZZZ

Upon request, each program manager would obtain an output listing of information by reference number for a specific set of selected mission areas. This list would then be available as part of the RFP package, and would contain all the information necessary for industrial competitors to acquire pertinent technology-based reports.

EXECUTIVE SUMMARY

DESIGN TO AFFORDABILITY: IMPLEMENTATION OF DoD GUIDELINES

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INTRODUCTION

During the past eight years, the Office of the Secretary of Defense and the military services have established and promulgated acquisition policies designed to produce systems and subsystems which will achieve predetermined affordability limits. These policies have been popularized under the titles of "Design to Cost" and "Design to Life-Cycle Cost."

This paper examines the key DoD guidelines for implementing the design-to-affordability policies and, based upon the author's experience as a consultant to industrial contractors, compares the intent of the guidelines with actual experiences associated with their implementation on current DoD acquisitions.

DoD GUIDELINES

Ten key guidelines for the Design-to-Affordability acquisition policy have been synthesized from the many DoD and service directives. They can be summarized as follows:

1. LCC Emphasis: Life-cycle cost should be a principal consideration.
2. Early Application: Design-to-Affordability initiatives should be taken early in the system acquisition cycle, and not later than the DSARC II milestone.
3. Program Flexibility: Program planning should contain sufficient flexibility in specification requirements, schedules, configuration identification, and standardization considerations to produce a balanced design.
4. Cost Goal Specification: Cost goals should be explicitly defined in terms of system quantity, production rate, price indices, content, cost elements, and Government-related cost factors.
5. Cost Goal Establishment Criteria: Cost goals or affordability thresholds should be estimated and set at a level that is difficult but achievable.
6. Cost Goal Achievement Visibility: Progress toward goal achievement should be continuously monitored, and variances between goal thresholds and current estimates should be visible to the Government and contractor program offices.
7. Cost Goal Management: Goals should be allocated and managed at lowest practical levels to permit design tradeoffs to be made with cost as a principal design parameter.
8. Contractor Organization: The Design-to-Affordability process should be integrated into existing administrative and financial organizational activities without additional program management or staff organizational structures.

9. Cost Goal Analyses: Cost goals should be continually analyzed to identify key cost drivers, subcontractor roles, and subgoal tradeoff opportunities.

10. Contract Incentives: Contractual incentives should be developed to motivate contractors to achieve affordability goals.

STUDY RESULTS

The results of the reported industrial contractor experience show that none of the guidelines have been applied and implemented without contractual or program difficulties. However, seven of the guidelines were achieving improved contractual success in meeting affordability thresholds. Three of the guidelines, with only limited exceptions, have not been implemented in such a manner to improve the acquisition process.

With the exception of program flexibility, goal establishment criteria, and organizational structure (Numbers 3, 5, and 8), all of the other guidelines were found to have been helpful for achieving affordability goals. Early programs, such as the original design-to-cost subsystem experiments, encountered many difficulties with implementation. But lessons learned on these and subsequent programs have resulted in improving implementation experiences. Concrete progress was noted, particularly in areas of LCC emphasis, early application, cost goal specification, and cost goal achievement visibility. The trend is toward improved management and ultimate success for goal achievement.

Major problems were found to exist in the implementation of guidelines calling for program flexibility (particularly schedule flexibility), goal establishment criteria (accurate cost estimation early in the program remains the major problem), and organizational structure. In particular, most contractors found that existing organizational structures and functional operations were not compatible with the cost goal management process, and that specialized organizational arrangements had to be developed for guideline implementation. With few exceptions, contractors were not organized to manage the design-to-cost process according to the guidelines as practiced by the commercial marketplace (reference JLC Guide, Paragraph 6.4). Much effort will be required in this area for successful compliance.

CONCLUSIONS

From the results of the study, it is concluded that most of the design-to-affordability guidelines are being implemented by DoD contractors with success ranging from fair to good. The trend is one of improving implementation as lessons learned from past programs are applied to successive procurements. A few guidelines are continuing to cause serious difficulties because of other acquisition-related constraints such as schedule priorities, estimating uncertainties, and past contractor organization adaptations.

Designing to affordability represents a significant change in the acquisition process, demanding widespread changes in the behavior patterns of industrial contractors. Recognizing that these fundamental changes require time and repeated assurances of DoD policy credibility, the results of this study are encouraging signs of policy success.

EXECUTIVE SUMMARY

IDENTIFICATION AND DEFINITION OF THE MANAGEMENT COST ELEMENTS FOR CONTRACTOR FURNISHED EQUIPMENT AND GOVERNMENT FURNISHED EQUIPMENT

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The Defense Acquisition Regulation (DAR) requires buying organizations to identify contract items that can be obtained directly by the government as opposed to acquisition by a prime contractor. The rationale supporting this requirement is that costs such as prime contractor overhead and profit can be saved if some items were acquired directly by the government and furnished to the prime contractor. The U.S. Air Force has identified the need for research into the decision process of whether to provide equipment to a prime contractor as government furnished equipment (GFE) or to require the prime contractor to develop or procure the equipment as contractor furnished equipment (CFE).

There are many considerations such as assumption of risk, technical uncertainties, life cycle cost, and incurrence of management costs which must be assessed in the CFE/GFE acquisition decision. Management cost is the cost of managing an item, which includes, for example, personnel costs and government or contractor overhead. Under the sponsorship of the Air Force Business Research Management Center, the authors conducted research concerning CFE/GFE management cost analysis. The objectives of the research were: (1) to identify and define the relevant and practical elements of contractor and government management cost that should be considered in the CFE/GFE selection process, and (2) to assess the use of these cost elements in the CFE/GFE decision. To satisfy these objectves four research questions were set forth.

1. What are the relevant elements of CFE/GFE management cost and what organizations incur these costs?
2. Are management costs adequately analyzed as a part of the CFE/GFE decision process?
3. Can the cost elements, as defined, be used on a practical basis by the people who make the CFE/GFE decisions?
4. Do sufficient data currently exist to enable development of a standard procedure for analyzing CFE/GFE management costs?

The research objectives were accomplished in two phases. First, a proposed list of management cost elements with associated definitions was developed from a study of the literature and by interviewing individuals experienced in systems management or contracting. In the second phase the list was provided to a sample of individuals currently responsible for making CFE/GFE decisions. Each person interviewed was given a questionnaire to assess the comprehensiveness, relevance, and practicality of the list of cost elements identified in the first phase.

The results of the research show that CFE/GFE management cost analysis is generally inadequate and that the absence of data regarding most cost elements precludes the immediate development of an objective management cost

analysis procedure. The research identified and defined sixty-five elements of management cost. The sample of CFE/GFE decision makers agreed with the existence and organizational placement of the cost elements. This list of cost elements as structured provides a baseline for potential development of a systematic cost analysis procedure.

Although the cost elements presented to the respondents are strongly considered as important, the elements are seldom used in CFE/GFE decisions. Forty-nine (seventy-five percent) of the cost elements are judged to be important to a CFE/GFE decision. Only one of the forty-nine important elements (profit) has been frequently used in past cost analyses. The conclusion is that CFE/GFE management cost analysis is currently inadequate.

A principal concern of the researchers was the development of a list of practical management cost elements. A cost element is practical if it is measurable, available, and cost effective. The respondents indicated that forty of the sixty-five cost elements (sixty-two percent) are not measurable and available. The conclusion is that a majority of the cost elements cannot currently be used on a practical basis. Because sufficient data do not exist for the majority of the cost elements, the researchers conclude that an effective standard procedure for management cost analysis cannot be developed at this time.

The following recommendations are provided to assist in alleviating the inadequacy of CFE/GFE management cost analysis:

1. The research was limited to Aeronautical Systems Division of Air Force Systems Command (AFSC). AFSC personnel should perform a study to determine if CFE/GFE management cost analysis is adequate within other buying divisions. The researchers believe that the research design used here will provide a valid assessment of the adequacy of CFE/GFE management cost analysis throughout AFSC. The AFSC study should include questions to ascertain why management cost elements appear to be not measurable or not available.
2. If a determination is made by AFSC that improvement in management cost analysis is required at one or more of the product divisions and required data is generated, then a standard procedure should be developed to aid in performing the analysis. The framework and the cost elements identified in this research could be used as a basis for the procedure.
3. No attempt was made during this research to determine if the structure of the contractor cost portion of the research framework correlated with the cost and pricing data submitted by defense contractors. Additional study may be required to determine if the contractor cost sections of the analysis framework can be adapted to match the format in which contractors submit cost data.
4. AFSC should issue policy guidance concerning the effect of moderating factors on objective cost analyses. If a CFE or GFE acquisition strategy has been predetermined because of a dominant moderating factor such as shortened procurement lead time or the desire for standardization, then a cost analysis should still be performed. The difference in cost between the CFE and GFE approach is an approximate indicator of the "cost" of the moderating factor. If the cost of the moderating factor is excessive, the predetermined acquisition approach should be reconsidered.

EXECUTIVE SUMMARY

DYNAMIC PRODUCTION PLANNING

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The acquisition of naval ships is a major planning effort, taken in concert with private shipyards. The private yard defines the construction project involved in terms of work packages summarized by nine categories such as Hull Structure, Propulsion Plant, Electric Plant, etc., together with time schedule for accomplishing the work. The work packages defined by the contractor are normally in such detail that in these terms it is very difficult to conduct project management. On the other hand, the aggregation of work packages into Summary Work Breakdown Structure provides such macro-technical data that one cannot sensibly model the process into a network showing the relationship and workflow of production activities, needed for project management.

From the experience gained in working on such problems in naval ship overhaul, it has been found feasible to aggregate detailed work packages into something like a ten digit classification level (consistent with naval Summary Work Breakdown classifications) as Production Activities in a logically directed network of production workflow. By a dynamic analysis of this projected workflow, it is possible to:

(1) Estimate minimal project time.
(2) Smooth manpower loading involved.
(3) Reprogram interrupted work progress.
(4) Evaluate contractor progress (man-hours, cost and work completion).

The network of Production Activities resembles a PERT-Network. However, it is actually a dynamic production structure. The operation of each Production Activity is defined by an intensity variable, varying in time, with lower bound to reflect minimal rate of work and upper bound to reflect maximal intensity implied by fixed resources and workspace. A sequence of ship completions, not necessarily identical may be programmed thru this structure, without treating each ship as an independent construction program. Manpower resources may be classified by the shops providing the skills and equipment needed, and programmed as independent inputs. A computer program has been developed to perform the analyses described above.

The work described above is a report on part of a program of research supported by Mathematical and Information Sciences Division, Office of Naval Research.

EXECUTIVE SUMMARY

ESTIMATING SYSTEMS REVIEWS, AN INQUIRY INTO THE INTENT AND RESULTS

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This paper is intended to be an exploratory one, not a final decision. It is confined to conditions noted in the Northeastern United States, specifically the area of the Boston Region of the Defense Contract Administration Services (DCAS) and the major portion of the Boston Region, and part of the Chicago Region of the Defense Contract Audit Agency (DCAA). It is based upon data from written surveys of government records, pertaining to all contractors under DCAS cognizance believed to be within the Contractor Estimating System Review (CESR) Program. The written surveys were supplemented by structured interviews with ACOs for approximately 14 business units subject to a CESR, and by review of applicable portions of the Defense Acquisition Regulation (DAR) (formerly the ASPR), Defense Logistics Agency Manual 8105.1 (DLAM), and Defense Contract Audit Manual 7640.1 (DCAM).

It is the premise of this paper that the majority of the Department of Defense contractors are privately owned entities with their own objectives, which they, in part, attempt to meet by contracting with the government. These private objectives are not necessarily opposed to the objectives of the government, but they are different. The pursuit of these objectives leads to conflict. The major arena for this conflict is the pricing of contracts.

The origin of pricing information is in most cases the contractor's estimating system. It is a given fact in this paper that the contractor's estimating system is not solely an internal concern of the contractor. But that, because of the requirements and mechanics of operation of Public Law 87-653, "Truth in Negotiations", the estimating system is also a legitimate subject of government concern, and thus is as subject to negotiation as are other government concerns such as price, quality, delivery, and social performance.

REGULATORY ENVIRONMENT

DAR assigns management of performance of the CESR to DCAA. However, each contracting officer remains finally responsible for the estimates from which he negotiates. DLAM establishes an ACO responsibility for the quality of all estimates from DCAS assigned contractors. DCAM tacitly establishes three types of CESR; the proposal CESR, the team CESR, and the operational CESR, with criteria for the use of each.

RESULTS

The result of the research indicates that many contractor's estimating systems currently do not meet the requirements of Truth in Negotiations, and thus fail a primary test for adequacy. Other estimating systems reveal inaccurate, or unrealistic estimating practices, thus failing another primary test of adequacy. The research further indicates that many CESRs do not have a significant effect upon the quality of the individual estimating systems. The limited data showed

a slightly higher average number of deficiencies at follow-up CESRs than at initial reviews. In addition to the above, the research indicates that CESRs are being performed on a reduced priority basis in accordance with the applicable DCAA regulation, but that the effect of this low priority is to postpone some CESRs for periods of up to a year, if not longer. The ACO interviews confirmed the survey data in broad outline and added two further items of data. The first is that ACO use of the CESR is relatively small, and ACO intervention into estimating system problems is restricted and hesitant. This is contrary to the spirit of DCAS instructions, though not the present letter. The second piece of data revealed was factual; a lack of PCO interest in estimating systems except in limited cases, and an ACO perception of PCO hostility (usually inactive) to actions, otherwise proper, which would delay or endanger the instant award.

CONCLUSIONS

It was the researcher's conclusion that current DCAA and DCAS practices are in near accord with the letter of their respective regulations. The major ACO deviation already being noted, and the auditors being confined to a misapplication of a team CESR dollar threshold to the operational CESR, thus unnecessarily restricting the number performed. The researcher further concluded that both agencies' actual practices are effective, efficient adaptations to the current reality in pricing. The researcher concluded that while practical, they are not producing the benefits cited by DAR 3-809 as the logical outcome of a CESR. It was the researcher's final conclusion that this unsatisfactory outcome was the result of defects in the primary Department of Defense policies establishing the current pricing environment.

SUGGESTED CHANGES

Improvement in two areas was decided upon as critical to improved success in the CESR. The first was an increase in the impact upon the contractor of the CESR (contractor motivation). The second was improvement in performance methods to support the increased effect of the review.

The incentive measures proposed were based broadly upon changing the contractor's costs/profit in accord with the responsiveness of his estimating system to the government's criteria. Further measures were the insulating of decisions as to acceptability of the estimating system, from the needs of the instant procurement/end item, and adding formal controls on the quality of the estimating system, and decisions resulting therefrom in order to raise the management visibility within the Department of Defense, as well as the contractor organization.

The performance method changes suggested were primarily the centralization at Region level of the currently decentralized procedures. Another change suggested was the establishment of joint, or at least non-duplicate, supervisory reviews of the quality of the CESR reports. This last resulting from the partially split nature of the estimating system responsibility.

It was the final suggestion of the researcher that changes in the impact of the CESR and methods of performance not be implemented separately, since the lack of one change obviates major benefit from the other.

EXECUTIVE SUMMARY

"APPLICATION OF LINEAR PROGRAMMING TO SONOBUOY ACQUISITION"

by LCDR Phillip I. Harvey, USN
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The U. S. Navy spends a considerable amount of money (approximately $900M during the current FYDP) for the procurement of sonobuoys.[1] In the past, these procurements have been handled through the normal competitive bidding procedure on a sonobuoy type by sonobuoy type basis. This has resulted in little or no correlation between the individual procurements and the resultant acquisition strategy across the product line has thus been largely incoherent. The application of this strategy has led to a degree of inefficiency from a business standpoint since optimal economic quantities have not been procured from the qualified vendors comprising the Mobilization Base.

In order to quantify the limiting factors of industrial base, quantity necessary, vendor minimum sustaining rate, and available funds in terms of the optimal quantity to procure from each vendor, a linear programming technique can be applied to an appropriately defined model. Within this model, the activity variables are defined as the quantity of each type of sonobuoy to procure from each vendor. The limiting constraints are defined as the minimum sustaining rate for each vendor, the maximum dollar limit for each sonobuoy type, and maximum vendor capacity for each sonobuoy type. The price of each sonobuoy type from each vendor is treated incrementally in accordance with a companion pricing model which is derived from historical data and current cost analyses. The linear program is now applied to determine either the minimum cost for a fixed number of each type sonobuoy to be procured or the maximum number of sonobuoys to be obtained for a fixed dollar amount budgeted.

Since differing constraints and objective functions can be defined for any multi-vendor large volume recurring procurement, this method can readily be extended to other products.

[1] An air deployable electronic device designed to radio relay ocean acoustic signals to the deploying aircraft.

EXECUTIVE SUMMARY

STRATEGY MODELS EMPLOYED BY FEDERAL ACQUISITION AND PROCUREMENT MANAGERS

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A partial list of the issues acquisition managers routinely must decide includes: how the program should be subdivided; what parts of it should be performed in-house or by contract; how many procurement actions are needed; when should each effort be completed (and started); what factors are critical in locating, qualifying, and selecting sources; what methods are required for estimating costs and prices; and what approaches are best for securing resources. In the federal system, decisions on these matters are influenced substantially by higher authority and to some degree by imputs from sources such as the procurement office and potential performers (in and out of house.)

The decisions on matters such as these are incorporated into an acquisition strategy upon which the success of the undertaking is largely dependent. They also form the basis for development of a procurement strategy for each contract to be awarded in pursuit of program completion. This study examines the concept of strategy in the federal system for acquiring goods, services and capabilities. It treats the accepted use of strategy in top management planning, then it addresses the concept as pertinent to the special circumstances of acquisitions. Strategic thinking creates a planning product that is integrative, its objective is holistic, and the burden it places on the manager is to consider and deal with all factors relevant to the undertaking. In short it is "the art of devising or employing plans or strategems toward a goal." If carried out in terms of these criteria, the acquisition strategy should increase confidence in the validity of the acquisitions process. It should improve the credibility of acquisition management.

The acquisition manager's position is an inherently risky one primarily because the role performed is that of a translator. Responsibility that program goals are met is carried by this person, but the determination of goals and objectives as well as the allocation of resources is that of general management. Furthermore, in acquisitions, the performance of much or all work is based upon a procurement relationship. The principal impact of this is that direct control over work efforts is not held by the acquisition manager. A contractual definition of the tools available for control is inherently limiting since the performing organization is essentially independent. This position is modeled in chart 1.

Chart 1
Positioning the Acquisition Manager

For the acquisition manager, one objective of devising an effective strategy is reduction of risk inherent in decision making. Beyond that, organizational effectiveness is dependent upon it. The specific organizational objectives for which an optimum acquisition strategy is requisite are:

1. Fulfillment of acquisition mission and goals
2. Pursuit of non-procurement objectives
3. Balance of cost and quality in performance
4. Enhancement of innovative behavior
5. Securing timely performance
6. Employment and preservation of competition
7. Satisfaction of supplier objectives.

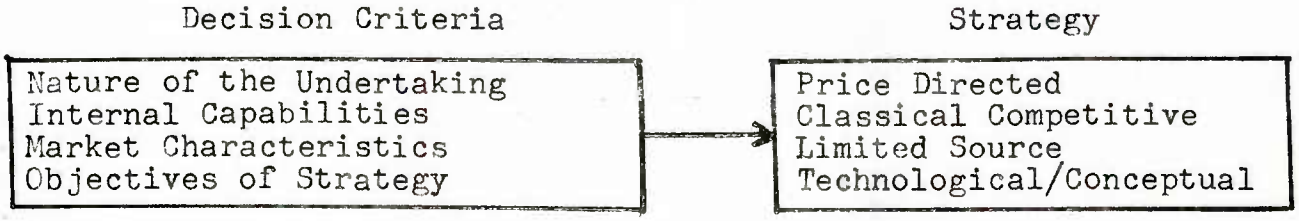
None of these objectives can be ignored, but each procurement in a program encounters a unique prioritization so that the elements of strategy must be selected with full recognition of the implications.

It is a proposition of this article that there are four general strategies pertinent to federal procurement. The acquisition manager is responsible for understanding each strategy and for ascertaining which is appropriate to the program and to each procurement action. The four general strategies are:

1. Price directed
2. Classical competitive
3. Limited source
4. Technological/conceptual.

Within these strategies there are several models that reflect specific source decision processes and specific price determination processes. The manager's approach to selection of appropriate strategy should be developed on the basis of decision criteria pertinent to the undertaking. A model of this approach is chart 2.

Chart 2
Procurement Strategy Model



A fuller treatment of these criteria and strategies is contained in the study. Also the article examines the relationship between these strategies (and their underlying models) and the proposed Federal Acquisition Reform Bill (S. 5.) This analysis verifies that the federal system contemplates using each of the four strategies. It can also be stated that the existing legal basis for the system provides for their use although the responsibilities of management are less clearly discernable.

EXECUTIVE SUMMARY

CONCURRENCY

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In January 1959, a report was published entitled "The United States Guided Missile Program." It was prepared by the Legislative Reference Service of the Library of Congress for the Senate Armed Services Committee. The report spoke to concurrency as follows: "[The Air Force]. . . has adopted and expanded another technique often used by industry where competition in getting to a market is very keen; that is compressing the periods of development of new products and getting production started. In the case of the missile program. . . the Air Force is undertaking to do this by what they call the 'concept of concurrency'," (1) The report also noted that the Navy's Polaris program is being accelerated and compressed in much the same way.

Through most of the 1960's, concurrency was an accepted approach in the sense of "the conduct of steps leading to production for inventory before the end of the full scale development time span." (2) Production funds were programmed and used during the latter stages of development. Then came some severe system acquisition problems. In several cases the problems were of such perceived difficulty that programs were cancelled late in development, with loss of production investment. Among these were MBT-70, Cheyenne, Condor, F111B, etc. The reaction was somewhat puzzling. Secretary Packard expressed the view, "As I reviewed program after program in the spring of 1969, almost all were in trouble from a common fault-production. They had been started before engineering development was finished. I am sure you all know all about this problem." (3) A RAND report (4) supported this view and recommended a sequential approach to major system acquisitions with clearly defined decision milestones. The current DSARC process is certainly consistent with the views noted.

During the Defense Science Board Study of 1977, data was accumulated on the relationship among the first demonstration of a full scale development item (normally first flight), the production decision date, and initial operational capability. There was a good correlation among many programs. The concurrent programs got to the field sooner. There were many reasons why programs got into trouble, but the fact that they were concurrent did not seem to be one of them.

The FBM program has always been one of many parallel activities, and concurrency has been a way of life. However, in 1973 the Navy did study the validity of their management approach. The objective was to answer the basic question, "Has the C-3 Missile (Poseidon) been degraded in any way because of concurrency?" The findings were to help structure the new Trident program. The costs of a non-concurrent program were analyzed compared to a concurrent program. The value of having the capability earlier was not assessed. Several alternatives were studied and the additional costs of a non-concurrent program ranged from $80 to $130M (1973 dollars). The general

conclusion of the study was that concurrency was the preferred approach for this program. The Deputy Secretary of Defense agreed and waived the provisions of DOD Directive 5000.1.(5)

The management of concurrency is demanding. Early full scale test articles must be as close to production hardware as possible. The whole development team must orient itself to the concept, and engineering decisions must be made with the objective clearly in mind. Comprehensive ground testing of subsystems is a requirement. There must be continuous evaluation of risks of production investment, i.e., material commitments, tooling and test equipment design and fabrication and facility preparation. Contract flexibility is essential.

The risks of early commitment to production have been well publicized—performance inadequacies, reliability problems, field fixes and return of equipment to the producer. There are, however, advantages to concurrency beyond cost savings and early capability. As noted in the Defense Science Board Study these include:

- A smooth transition from development to production.
- Reduces personnel turbulence and inefficiencies.
- Forces a planned "end of development."
- Drives the total system to be ready.
- Ensures a continuity in manufacturing processes, quality assurance and inspection programs and in providing flight qualified hardware.

Finally, the following extract from the testimony of Rear Admiral Levering Smith, Director, Strategic Systems Projects, in March 1976 is worthy of your consideration:

".....it is most likely that production of a quite similar product made from identical materials, on the same equipment, with the same tooling, by the same people, using the same processes and procedures will not continue if 'fly-before-buy' is enforced. Then, because it is completely impractical to specify materials and define processes at all component levels, when production is instituted after completion of the 'fly' test program, it will be found that the items produced do not perform in the same manner as the item 'fly' tested and hence making it necessary to re-develop the production processes and generally also change the product design; as well as repeating much of the testing. This was well recognized twenty-five years ago but many whose experience extends that far back have forgotten and most who do not have that length of experience have not learned."

(1) Congressional Record, January 27, 1958.
(2) Defense Science Board Report of the Acquisition Cycle Task Force, 15 March 1978
(3) Defense Industry Bulletin, Fall 1971
(4) RAND Report, "System Acquisition Strategies," by Robert Berry, et al, June 1971
(5) Memorandum for SecNav from DepSecDef, 16 July 1973

EXECUTIVE SUMMARY

THE IMPACT OF ENERGY COST ON ACQUISITION CONTRACTING

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In FY 1977 the energy expended in the production of defense materiel was about equally divided between Government in-house operations and the acquisition of goods and services contracted for with commercial vendors. The increasing cost of crude oil continues to threaten the viability of the U. S. Military Industrial complex with the potential result of producing a second rate national economy and military defense force. While some progress has been made to reduce in-house energy consumption, little success has been made in influencing energy conservation throughout the commercial sector.

In July 1977 the President issued Executive Order 12003 which set the stage for a national energy conservation policy.

A review of the DOD Directives reflects a dearth of specific guidance and direction on energy conservation. Only recently has the Defense Acquisition Regulation, DAR 1-339, addressed the subject of energy conservation in a general way. Other programs such as Should Cost, DAR 1-337, and Design to Cost, DAR 1-338, skirt the issue of energy conservation and leave the potential for energy conservation to the discretion of the respective military service. Two initiatives to evaluate compliance with the President's call for increased energy conservation were undertaken by the Defense Contract Audit Agency and the General Accounting Office. Subsequent to the President's call for energy conservation in 1974, the DCAA performed an audit on 200 DOD contractors to ascertain the extent to which defense contractors had responded to the President's request to conserve energy. The results revealed that while some contractors had responded with positive results, further emphasis was needed to encourage the private sector to conserve energy.

In 1975, the GAO visited 75 federal installations to monitor energy conservation. The GAO reported that while facility management officials "had been active attempting to conserve energy" much more could be done. Some criticism included a call by government officials for increased encouragement to the commercial sector to conserve energy.

DOD as currently structured could include energy conservation in the myriad management and survey teams presently in being. Various audit and pricing personnel, pre-award survey teams, industrial specialist, etc. can be tasked to provide input on energy conservation without increasing the federal bureaucracy.

The importance of program managers and contracting personnel maintaining an awareness of ongoing projects and research grants in energy conservation cannot be over-emphasized. It is necessary that continuing cross communication be established between governmental agencies in the field of energy conservation research.

Initiatives by the U. S. Air Force in the Flight Simulator programs which simulate flight training with ground trainers is a major program to reduce energy conservation. The Navy's desalination program and projects in hydrogen and nuclear fields promise major contributions in fostering energy conservation.

The continuing challenge to design and produce the most economically efficient product will become more acute as energy resources become increasingly scarce and costly.

EXECUTIVE SUMMARY

SHOULD COST - STILL A VIABLE COST ESTIMATING TECHNIQUE

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In 1967, the Department of Defense (DOD) instituted its first Should Cost Study at the Pratt & Whitney Aircraft Division of United Aircraft Corporation, the contractor for the F-111 TF-30 jet engine. Since that time, Should Cost has drawn a varying degree of support from the Services. By 1974, the Air Force had conducted at least 23 studies, the Army nine, and the Navy three, including the original Pratt & Whitney study. Though perhaps today Should Cost does not display the preeminence it once did in the early Seventies when it was thought to be a possible cure for the DOD's cost overrun problems, the principles and objectives of the Should Cost technique may still be an answer to the cost overrun, inflation, and declining productivity problems facing the United States and the Department of Defense today.

In this study, the Should Cost technique was evaluated through a review of the literature, supplemented with interviews, to determine whether this technique could contribute to reducing the apparent inflationary and inefficient practices of the defense industry. Through this review, it was shown that cost estimating techniques such as historical analysis, grass roots, and parametric estimating do not allow the Government to study in-depth the contractor's proposal at his facility, a necessity when the Government is faced with the sole source environment of follow-on buys of major weapon systems.

Should Cost was also compared to such techniques as Pre-Award Surveys and Production Readiness Reviews. Though these two techniques require studying the contractor's proposal at his facility, they do not evaluate the contractor's efficiency as Should Cost does; rather, they determine whether the contractor is able to perform.

Next, the seven phases of a Should Cost study (preliminary effort, advance team on-site preparation, negotiation preparation, and negotiation) were reviewed. Potential problem areas, such as study responsibility, differences in approaches by the Services, study selection criteria, team size, and personnel difficulties, were highlighted. Further the benefits of Should Cost were weighed against the cost of the study itself.

Several previous studies on the benefits of Should Cost were reviewed. It was suggested that, although one study on Should Cost concluded there was no statistical difference between the benefits derived from using Should Cost versul other cost estimating techniques, the DOD could possible realize a ten percent less negotiated contract price over other techniques, and therefore Should Cost would be useful in combating the inflationary pressures existent in the defense industry today.

Recommendations made throughout the paper to improve/expand the use of Should Cost were summarized as follows: (1) each Service should conduct their own Should Cost study, rather than the General Accounting Office, as was suggested, (2) a formal Should Cost report be written in addition to the Price Negotiation Memorandum (PNM), (3) continue to use Should Cost for follow-on buys, (4) pay particular attention to proposals based on learning curves, (5) plan ahead during acquisition planning to allow time for a Should Cost study, if required, (6) vary team size with proposal dollar size and complexity, (7) long Should Cost studies should be planned to include time for team members to return home for short visits, and (8) establish a Should Cost study data base to provide for a corporate memory.

Lastly, recommendations for further research, such as combining Should Cost studies with Value Engineering, or using Should Cost techniques for investigating inefficiencies within the Government, were offered. The paper was concluded by stating that, although the Should Cost technique is not a panacea, it is a viable alternative to other pricing/costing techniques.

EXECUTIVE SUMMARY

A UNIFORM PROFIT POLICY FOR GOVERNMENT ACQUISITION

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The Logistics Management Institute (LMI) undertook a study for the Office of Federal Procurement Policy to develop a uniform government-wide profit policy for determining equitable profit objectives to be used in contract negotiation. Negotiated procurement accounted for approximately $55 billion of the $75 billion in total procurement of goods and services by all Federal agencies in 1977.

The need for a study of this nature was recognized in 1972 by the Commission on Government Procurement. It was noted then that contractors doing similar work for different agencies operated under different profit policies and even different profit rate limitations. In addition, it became clear that the basis on which the negotiated level of profit typically was calculated, estimated contract costs, could motivate contractor behavior that was inimical to the government's best interest. Finally, there appeared to be no rationale, other than past government practice, to judge the equity of profit levels.

Profit is intended to compensate a contractor for

- the use of capital resources;
- the assumption of risk; and
- the entrepreneurial function of organizing and managing resources.

The uniform profit policy recommended by LMI has two formulas: for contracts in the service sector of the economy, a profit formula based upon cost is applied; for contracts in the manufacturing and construction sectors, a profit formula based upon both cost and capital (referred to as a hybrid) is applied.

The following principles are embodied in the recommended policy:

- the profit policy should support the primary government acquisition goal of least overall cost to the government;
  - -- for service contracts the government does not materially benefit from increased use of facilities capital (plant and equipment); consequently a formula in which profit is calculated as a percentage of the estimated cost of performance is recommended;
  - -- for manufacturing and construction contracts on which the increased use of facilities capital and the increased utilization of existing facilities can lower total acquisition costs to the government, a profit formula based upon estimated capital employed and estimated cost is recommended;
- the target profit rates should be derived from commercial rates and updated annually to incorporate recent commercial experience.

The cost based profit formula for service contracts reflects a commercial equivalent rate of earnings before interest and taxes of 7.2 percent return on cost.

Adjustments are made for both the cost recoupment risk associated with different types of contracts and the entrepreneurial skill required for complex tasks. Including adjustments the target rate of return on costs varies from 5.7 percent to 9.7 percent.

The hybrid profit formula for manufacturing and construction contracts reflects a commercial equivalent rate of earnings before interest and taxes of 16.6% return on capital. Including the same adjustments as above, the target rate of return on capital varies from 14.1 percent to 20.7 percent or, expressed as a return on cost, from 8.5 percent to 12.5 percent for the firm with average characteristics.

The recommended profit policy will not by itself ensure that contractors configure themselves most efficiently for government work. There are many other influencing factors such as the government's policy toward taxes, depreciation, the expensing of or government purchase of partially used contractor facilities and equipment, and contract termination protection. A profit policy can, however, recognize and reward all of the functions of profit listed above while not discouraging cost savings and cost saving investments.

EXECUTIVE SUMMARY

THE CIVIL AGENCY CONTRACTING OFFICER ROLE: TRAINING FOR HUMANITARIANISM

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The Federal Acquisition Institute estimates the number of full-time civil agency employees working in the acquisition field at more than 21,000. Of these, more than 4,000 are contract officers who ultimately oversee fiscal and performance responsibility for contract awards annually totaling several billions of dollars.

The volume of dollars and numbers of contracts that civilian government agencies award and administer has increased dramatically in recent years to support our Nation's increasingly complex needs in the health, social and education fields. The Department of Health, Education and Welfare (DHEW), for instance, awards nearly $2 billion in contracts each year and another $5 billion in discretionary grants.

The civilian agency contract officers who negotiate, award and monitor these billions in taxpayer money include within their ranks the government's most dedicated, hardest working civil servants. Each civilian contract officer in the Office of Education "manages" nearly three times the numbers of contracts of his counterpart in the military acquisition field. On the average, the same Education official will be at least one general schedule grade lower and will receive only one tenth the formal training of his military counterpart over a 20-year span.

THE CONSEQUENCES: FRAUD, ABUSE AND WASTE

Far too often the civilian contracting officer is ill-prepared to do the job efficiently. Fraud, abuse and waste are the inevitable consequences. Among the major deficiencies uncovered in a 1977 DHEW self-assessment probe were:

- Failure to schedule procurement awards. More than 60 percent of procurement awards were made in one quarter - the final one.
- Failure to protect the Government's best interests in competitive procurement. Evaluation criteria often did not support contract objectives.
- Failure to limit noncompetitive procurements.
- Failure to ensure contract performance throughout the contract period.

- Inadequate review and selection procedures.

- Inadequate price and cost analyses.

Although the DHEW promptly sought remedies for their problem areas, inestimable numbers of underprivileged, handicapped and other deserving individuals did not fully benefit from those contractually (or grant) funded programs which had "missed their social or educational mark."

In closer human perspective, when socio-economic oriented government programs fall short of their goals, a blind person may never "read"...a member of a minority may never speak or understand English...or someone will suffer or die from a preventable disease - all because a contracting officer wasn't trained to do his job properly.

STEP UP TRAINING: INCREASE EFFICIENCY

The several civilian agencies which perform procurement tasks must encourage and support more and better programs to establish uniform, basic skill needs for ALL contract managers. The good work of one well-trained procurement official is quickly undone by one unqualified contract officer.

This paper discusses areas of general deficiency in civil agency procurement training and offers practical suggestions to match training to objectives.

Areas of discussion and suggestion include:

- Establishment of fellowship programs at the GS-12, 13 and 14 levels for MBA's in Federal procurement.

- Providing "exchange" training programs between contracting officials in the military, civilian agency and private sector.

- Emphasis on the use of video tapes and film as an effective and comparatively inexpensive means of providing standardized training simultaneously to large groups of civil agency contract managers.

* * *

EXECUTIVE SUMMARY

SHORTENING THE ACQUISITION CYCLE

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Why are we so concerned about shortening the acquisition cycle of our major Government procurement systems? After all, the United States is still the most advanced and "strongest" nation in the world. Besides, there are many more important issues that require our immediate attention. Inflation with a range of 6.5 to 8.5 percent, unemployment fluctuating around 6.2 percent, the Salt Agreement, emphasis on income maintenance programs, unrest in the Middle East, and most important the oil uncertainty, are by far more critical than the time it takes to procure a major system. The answer is obvious - nearly all of our nations' concerns affects the Federal Defense Budget in some fashion. Since the bottom line is dollars and time relates to the expenditure of funds, many of us are concerned with streamlining the acquisition time period between the inception of an idea (Milestone O) through to the Initial Operational Capability (IOC) was reaching 10-18 years instead of the normal six to seven years. The trend in the Acquisition life cycle has been on the rise; thus the Congress, Office of Management and Budget (OMB), the Department of Defense (DoD0, individual services, agencies, industry and associated societies have concentrated on ways to shorten the acquisition life cycle.

The intention of this paper is to express ways, in a general sense, that will lead to identifying the complex and inter dependency components of our military (and agencies) major acquisition process. If the acquisition period is broken up into two main categories, the first part of the problem deals with technology complexity while the second is concerned with the administrative process. The components of technology complexity depend on the status of the present state-of-the-art, degree of risk assessment and priority of the need. The administrative process is determined by the urgency of the need and the size of the expenditure. Add to these components the "uncontrollable" workings of the process. These are: the extensive reivew cycles of the military (called bureaucracy), the constant turnover of service and appointed (or elected) key personnel, the continual changes in the acquisition process, i.e., zero base budgeting, OMB A-109, Mission Base Budgeting and administrative changes just to mention a few.

Concepts of flexibility, consolidation, concurrency and subjective additions of authority to a Program Manager are this year's approach to streamlining the acquisition cycle. Examination on the implementation on a couple of these concepts is appropriate even if only for the stimulation of future ideas.

CONSOLIDATION AND CONCURRENCY

Recommending the elimination of the many layers of review cycles a program experiences is not a first. However, when a program is being shared by two or more services, i.e., (NAVSTAR-GPS) -- by the (Navy/Air Force), each service should not have to attend AFSARCs and NSARCs briefings/revisions independently of one another. This parallelism is unnecessarily expensive and risky. These review procedures and pre-briefings are not separate and distinct but rather inter-related and inter-connected. Each service tends to concentrate on its own reviews which has resulted in duplicative and parochial efforts in developing major acquisition systems. Rather than let each service establish its own implementing directives, consolidation and standardization here is the key.

Depending on the complexity of the program and the stage or milestone in question, the combining of these review periods must be left up to the discretion of the Program Manager. If a standard implementation procedure is used to consolidate the number of program briefings without minimizing control; the time span in the acquisition cycle will be reduced. The concern here is how does one implement or delegate authority of such a nature.

The consolidation of review cycles is certainly a possibility. This must become a way of life during the pre-briefings that take place in preparation for the DSARC process. The Program Manager must be allowed to combine reviews of the Base Commander, Deputy of Procurement, Comptroller, Program Office Organization and etc. Latest revision of the DoD 5000.1 series is promoting the concept of concurrency. This certainly would help in the procurement cycle of acquisition Concurrency must become a standard practice in the review of documentation.

These criticisms are not new or unique. The solution for shortening the acquisition process has escaped the instruction manuals and the ASPRs thus far. The consolidation of review groups, more decision making authority for the Program Manager, flexibility and standardization in the administrative process is rhetoric unless we face the challenge of simplification.

DETERMINATION OF ACQUISITION REQUIREMENTS IN THE DOD

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EXECUTIVE SUMMARY

This study has three objectives:

o To examine the DOD and Service requirements determination process in a comparative manner including the impact of OMB Circular A-109,

o Assess the issues associated with the changes, and

o Recommend changes to the Services requirements documentation process to streamline the process while providing an adequate audit trail for materiel acquisition based on anticipated procurement funding profiles (affordability).

The basic findings in the Services' implementation of DODD 5000.1 and DODD 5000.2 are:

o The Army has updated regulations to implement the MENS and milestone "0" but has failed to take full advantage of this process to streamline the requirements generation process. It is recommended that the LOA & ROC be eliminated and TRADOC prepare updated MENS and portions of the DCP to support the decision-making process rather than the LOA and ROC documents.

o The Navy lacks the implementing instructions (other than SECNAVINST 5000.1) for the A-109 initiative and also lacks analysis personnel at OPNAV sponsoring organizations to accomplish the MENS process properly. The Navy must eliminate the bow wave of projects and provide resources only to projects that are affordable within the Navy's realistic procurement budget in the out years.

o The Air Force has more concern with keeping projects alive than fulfilling the mission requirement. The PEM works in the programming and budgeting but requires much closer organizational ties with the user and doctrines personnel as opposed to the developer.

o The application of A-109 by the Office of the Secretary of Defense is not totally clear. DOD is still hardware oriented. The issues of mission areas, risk assessment and affordability remain unanswered from A-109. The funds remain separate from the DSARC/DCP decision.

SUBDIVISION OF LABOR REVISITED
(Notes Toward a General Theory of Manufacturing)

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EXECUTIVE SUMMARY AND CONCLUSION

THE CONCEPT AND CONCLUSIONS

If a worker performs a complicated job it will take him by definition one unit time. If the job is subdivided into many subtasks (to be performed by many different workers), then each worker will repeat his small subtasks many times during the unit time. With each repetition he will do his job faster and faster; he will learn until he reaches a certain performance plateau. At this plateau a group of workers will produce more than if each of them would have to produce the entire job. This is the gain of learning due to the subdivision. The subdivision, however, creates interfaces between the parts, and the interfaces must be managed in order to make a whole again out of the parts. Hence, the cost of the management of the interfaces is the loss because of the subdivision.

The learning because of the subdivision is used to measure the gains. The complexity or the number of interfaces to be managed is used to measure the losses. Depending (1) upon the achievable learning plateau and (2) the complexity of the interfaces, either an optimal size for an operation exists or the Economy of Size continues unlimited. The criterion is the achievable learning rate:

. *All operations where a learning rate of 0.5 or better (0.4, 0.3, etc.) can be achieved are conceptually unlimited in size.*

. *All operations where only a learning rate of 0.5 or worse (0.6, 0.7, etc.) can be achieved are conceptually limited in size and a definite optimal size exists.*

. *Learning rates better than approximately 0.75 (0.6, 0.5, etc.) can only be achieved through investment, and the prevailing ratio of cost of labor versus cost of capital determines the best mix on a case by case basis. However, no optimum mix can be determined on a conceptual basis alone.*

EXECUTIVE SUMMARY

TITLE: THE IMPACT OF FREEDOM OF INFORMATION REQUESTS ON THE CONTENT OF CONTRACTOR TECHNICAL PROPOSALS

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ADVISOR: MAJ HUDSON ACSC/EDCM

I. Purpose: To determine if the threat of a Freedom of Information request has caused contractors to withhold state-of-the-art technical information from their proposals.

II. Problem: The proposals contractors submit to government agencies for evaluation in source selection contain the companys' latest state-of-the-art technology. Subsequent to the contract award, the proposals may be released (subject to some restrictions) to anyone making a Freedom of Information Act request for them. If this threat of release of contractors' proprietary information has encouraged them to withhold technical information from their proposals, the source selection evaluation boards may find it more difficult to effectively evaluate proposals. The contracts could then be awarded to a contractor who is less capable technically than another.

III. Data: The Freedom of Information Act, and the implementing DoD Directive and Air Force Regulations, are neutral with respect to the release of information (for example, trade secrets or "proprietary" information) submitted to the government. That is, the information may or may not be released, subject to the decision of the government agency.

If a government agency (including an Air Force program office) determines that the technical information being requested does not impair the contractor's competitive position or jeopardize the government's ability to obtain necessary information in the future, it may comply with the request. Thus, when the contractor submits his technical proposal to the government the proprietary information could be released to anyone. Even if the contractor indicates that it wishes its proprietary information protected, it has no assurance the government will do so. This lack of protection may encourage contractors to withhold proprietary information from the proposals they submit.

IV. Conclusions: Based on a survey of aerospace contractors and DoD program offices, some contractors are withholding proprietary technical information from their proposals. However, the program offices have not observed a lack of state-of-the-art technical information in the proposals they have evaluated. Furthermore, the program offices are generally of the mistaken opinion that proprietary information is not releaseable, even in response to a Freedom of Information request.

V. Recommendations: The Department of Defense should establish a dialog with the defense industries, or their representative associations, with the purpose of ensuring the participants are informed of the impact of the Freedom of Information Act on the release of technical information and kept abreast of federal court interpretations of the Act.

EXECUTIVE SUMMARY

CREDIBILITY OF BUILT-IN-TEST SPECIFICATIONS AND CONTRACT DEMONSTRATIONS

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INTRODUCTION

Maintaining increasingly complex military electronics is a problem all Military Departments face. One approach to this problem is to design equipment that can monitor its own performance, indicate when a malfunction occurs, and then assist the maintenance personnel in locating faults. The function of the weapon system that does this monitoring, malfunction detecting, and assisting in fault location is referred to as Built-In-Test (BIT).

The advantages of BIT are many. Operational readiness will be improved as mean repair times are reduced because of BIT fault isolation capability. Potential cost savings may result not only from using a smaller number of less skilled maintenance personnel but also from reduced requirements for training, test equipment, and maintenance documentation. In addition, operators can use BIT before and during missions to obtain status of equipment critical to safety and mission success.

Inherent disadvantages of BIT include the additional cost for developing and testing BIT; the increased weight, increased power requirements, and decreased equipment reliability due to the additional circuitry required by BIT; and the difficulty in specifying BIT in a meaningful manner that allows validation of contract compliance. Of greater importance are the disadvantages that occur if BIT does not operate as predicted. When logistics decisions on maintenance manpower, test equipment, quantity of spares required, etc. are based on levels of BIT performance that are not achieved, operational and support costs as well as operational readiness will differ substantially from the predicted values. We, therefore, need a high confidence the predicated BIT performance will be realized in fielded systems.

In order to obtain information on how BIT is procured, the Offices of the Deputy Under Secretary of Defense Research and Engineering (Acquisition Policy) and the Deputy Assistant Secretary, Manpower, Reserve Affairs and Logistics (Requirements, Resources and Analysis) have initiated a DoD BIT Acquisition Study.

DoD BIT ACQUISITION STUDY

The DoD BIT Acquisition Study is being performed by the DoD Product Engineering Services Office. The study is making maximum use of other on-going studies and collecting additional information from program offices, testing agencies, and contractors. It will address the following questions:

2. How is BIT being demonstrated during factory acceptance, development, and operational tests?

3. How does BIT field experience compare with specified performance and with test and evaluation results?

4. What should be the DoD policy concerning BIT?

Phase one of the two phase study was a "scratch-the-surface" overview of BIT in military systems. This phase included discussion of existing problems with people involved with BIT and a review of current BIT-related studies and research efforts. The major preliminary findings are: (1) BIT terminology is often ambiguous, (2) many potential BIT cost savings are lost when the BIT requires a long period to mature, (3) it is often unclear whether BIT-detected failures that cannot be duplicated are due to faulty BIT or to inadequate simulation of the proper environment during testing, (4) high system availability or low mean repair times may implicitly require BIT without contract specifications of BIT performance, and (5) existing field data collection systems do not identify how well BIT is working. An output of this phase was a list of weapon systems to be studied in phase two.

The second phase of the study has just begun. Ten systems were selected to cover different operational environments, different methods of specifying BIT, and different operational/fielded status. A data collection outline has been prepared for use in visits to be made during the next five months. Available data will be collected on BIT specifications, BIT factory demonstrations, operational tests, and field experience. This data will be analyzed and will lead to recommendations for DoD policy concerning specifying and demonstrating BIT.

EXECUTIVE SUMMARY

EXPERIENCE CURVE THEORY AND THE PRODUCT LIFE CYCLE

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Experience curve theory proposes that the cost and price per unit of production decrease indefinitely as the total quantity produced increases. Graphically:

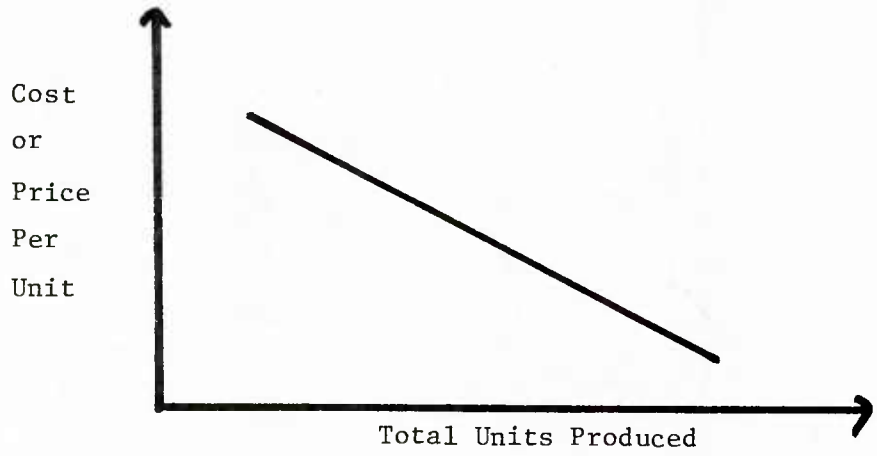

Figure 1. Experience Curve, Logarithmic Scales

The product life cycle concept suggests that products progress through a standard sequence of phases over time, with cost and price increasing late in the life cycle. Graphically:

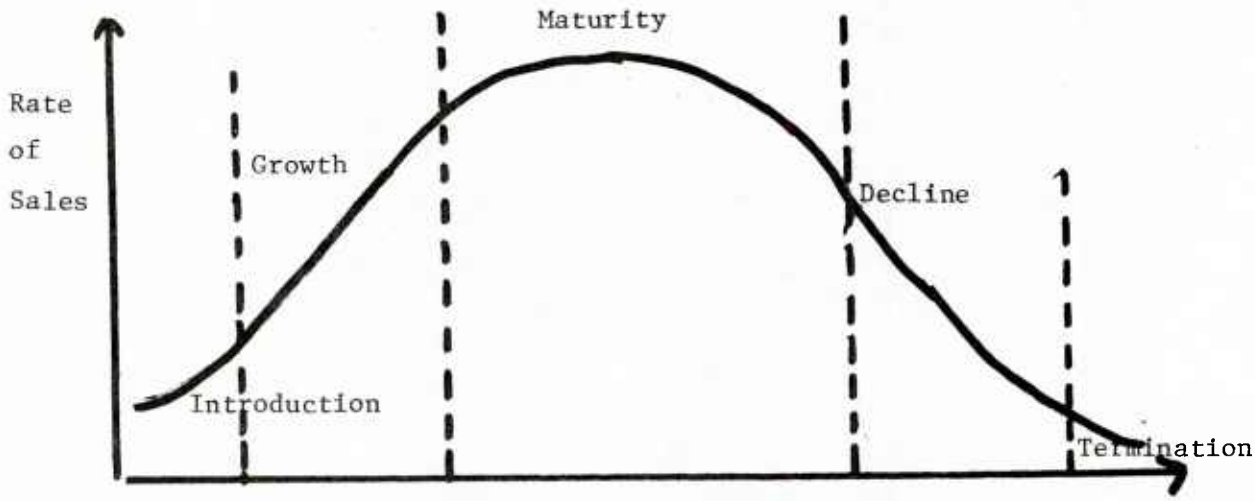

Figure 2. Product Life Cycle Phases

This paper expounds upon both concepts and resolves the apparent contradiction suggested above. The two concepts are shown to be basically complementary and mutually supportive, both valuable tools for the strategic manager.

EXECUTIVE SUMMARY

Will Four-Step Solve the Problem?

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BACKGROUND

The Department of Defense source selection process of negotiated acquisitions has been plagued by charges of unfair competition and unsound business practices for years. Beginning with the Harvard Weapons Acquisition project in 1962, continuing with various Industry studies in the 1960's through the findings of the Commission on Government Procurement released in the early 1970's, DOD weapons systems acquisition procedures have come under close scrutiny and increased criticism. Past statutes have failed to control, and even encouraged such practices as "technical leveling," "technical transfusion," "auctioning," and "buy-ins." Poorly written Requests for Proposal have added to the confusion and uncertainty surrounding the source selection process. In 1976, DOD began a two year test study of a source selection method called "Four-Step" which had been adapted from NASA procedures. The four steps in the process are (1) submission and evaluation of technical proposals; (2) submission and evaluation of cost proposals as well as revisions to technical proposals; (3) the establishment of a common cut-off date for "best and final" offers and selection of the apparent winning contrator; and (4) negotiation and award of a definitive contract. This study examines the source selection process as seen through the eyes of twenty San Francisco Bay area contractors. It describes problems experienced under past source selection processes and analyzes whether or not Four-Step will solve these problems.

REVIEW OF SOURCE SELECTION PROBLEMS

Poor Requests for Proposals (RFP). The surveyed contractors contended that work statements were usually poorly constructed and ambiguous. Specifications frequently contain unrealistic and peculiar technical requirements that can needlessly increase the price of the required product. The length of RFP's was considered needlessly long by all contractors surveyed.

Evaluation Criteria. DAR 3-501(b) prevents the disclosure of numerical weights assigned to the evaluation factors in the RFP. Nineteen of the surveyed firms contend that the degree of competition would increase if such weights were listed.

Past Performance. This is a factor which would seem to be a potentially valuable contractor motivation tool. The fact that it is not currently used (even though nominally provided for in paragraph III.D.1 of DOD Directive 4105.62) is puzzling. Most of the Bay Area contractors sampled felt that past performance should be ranked second behind technical capability, and certainly ahead of price.

Proposal Response Time. Thirty days is rarely enough time to formulate a competitive proposal for a major system. The contractor's bid/no bid

decision must be carefully weighed, proposal team formed, strategy developed, and technical, management, and cost packages written in the remaining few days. As a result, competition is discouraged; time and money are wasted by contractors trying to do advance work on less than perfect information; innovation is time-restricted; and the eventual proposals, coordinated within companies at great cost and expenditure of overtime manhours, will have inevitable errors, complicating the Government's evaluation task.

Discussions/Negotiations and Contract Award Phase. Representatives of the firms contacted felt that no other phase of the source selection process has been subjected to so much abuse and subsequent analysis as this one. The Government's policy of negotiating essentially with all offerors simultaneously, apparently has been the root of many of the problems suffered by major systems programs in the last fifteen years. The fact that DOD is a "monopsonistic" buyer distorts its bargaining position with Industry and compounds the faults inherent in a policy of negotiations with all offerors. It was felt that the Government policy of simultaneous negotiations with all offerors in a monopsonistic environment leads to technical leveling, technical transfusion, and auctioning, with all of the above then culminating in Industry buy-ins. Such buy-ins in turn, have led to program cost overruns, schedule delays, performance failures, and considerable political difficulty.

FINDINGS

It is unlikely that any new Government regulation or set of procedures can completely eliminate all abuses of past acquisition practices. No regulation can change the fact that DOD is a monopsonistic buyer. No regulation can realistically eliminate all factors which motivate contractor buy-ins. Procedural changes, not new regulations can accommodate the alleged failure of DOD to properly weigh prior contractor performance. Four-Step at least addresses the other principal procedural problems. It changes past regulatory requirements which not only allowed the abuses, but actually encouraged some of them - leveling, transfusion, auctioning, and buy-ins.

Use of Four-Step procedures will force more extensive presolicitation Government-Industry dialogue, something urged for years by contractors. Since discussions are limited, offerors need to know exactly what the Government wants. It will be in the Government's interest to promote clear and well-written RFP's. In the past RFP quality was not really necessary. The Government could get what it wanted by guiding discussions, identifying deficiencies, and having contractors revise their proposals. Government Contracting Officers may start listing their evaluation weighting schemes in RFP's in a further attempt to aid understanding of the solicitation by Industry. The better the RFP, then the better the proposals will be, and the more effective Four-Step will become.

Strict adherence to Four-Step procedures will eliminate technical leveling and technical transfusion; it will greatly reduce auctioning; and buy-ins - since no longer strongly encouraged by the Government - will also decrease. Adoption of Four-Step by DOD is a sign that the Federal Government is indeed serious about trying to improve the acquisition of defense weapon systems.

EXECUTIVE SUMMARY

THE IMPACT OF INTERNATIONAL PROGRAMS ON THE ACQUISITION PROCESS

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Since World War II various international defense programs, developed by the U.S. to strengthen allied military forces and enhance U.S. national security, have increasingly influenced the defense acquisition process. Requirements personnel have long considered the benefits of economies of scale engendered from grant-aid and foreign military sales (FMS) programs in determining U.S. needs. Off-shore procurement regulations, formulated in the 1950's, provided detailed procedures to U.S. contracting officers when buying in an overseas environment.

In 1956 Canada and the U.S. agreed to a mutual defense cooperation program which provided industry in both countries equal competitive opportunity in each other's defense requirements markets. Similar agreements have recently been concluded with a significant number of countries including our NATO allies which permit industries in these countries the ability to enter the U.S. defense acquisition process without restrictions. Offset provisions included as part of FMS or cooperative production agreements can specifically require a certain amount of international contracting effort. As a result some defense acquisition programs, in terms of both scope and production, will become international as they are national.

Today the acquisition official works in a multi-national environment. Requirements determination must include assessment of NATO systems and subsystems for achievement of standardization and interoperability. Research and development efforts must consider using collective technology resources. Contracting officers may evaluate proposals and negotiate with international firms heretofore unfamiliar with U.S. contracting regulations. Contract administration and inspection can be a world-wide undertaking.

The task facing the acquisition official in melding the requirements of international programs into an acquisition management system that is measured in terms of cost-effectiveness versus performance is complex and at times contradictory.

As a minimum the acquisition official wrestles with such problems as:

1. Negotiating licensing and data rights agreements with foreign contractors that preclude release of technology to non-participating third parties.

2. Establishing of procedures to control sales to third parties.

3. Appreciating of foreign costing systems and how international monetary fluctuations can affect a U.S. dollar budgeted program.

4. Understanding the business relationship between a foreign industry and its government.

5. Formating of the contractual vehicle that will meet regulatory conditions imposed by the government of all the negotiating parties.

6. Establishing of controls to monitor acquisition progress when communication channels are not necessarily direct.

7. Building delay allowances into program deadlines to compensate for distance and language problems.

8. Resolving measurement standards and developing a quality control program meeting the standards of all parties.

9. Interpreting foreign negotiation techniques derived from different marketing concepts.

Before the U.S. acquisition manager can be totally effective in this environment, proponents of international programs must resolve the differing opinions present at various levels of the U.S. government as to the propriety and benefits to be gained in such an undertaking. If multi-national acquisition is to become a modus vivendi, congressional backing must be a necessary objective.

The Department of Defense (DOD) must develop coordinated and simplified implementation procedures. This must include a monitoring of system competition. Above all the U.S. approach to relationships with foreign industry must reflect impartiality in that domestic and foreign industries operate competitively as equals.

The success of international programs, be they mutual defense cooperation or co-production agreements, meeting offset requirements or co-development projects is dependent on the DOD commitment of resources to meet these objectives. The relationship of international programs to other unique national programs, particularly in the socio-economic area that also impact the acquisition process, must be defined, prioritized and disseminated. This type of policy guidance will be needed to meet any established goals and, more importantly, to overcome a natural predilection on the part of Congress, the DOD acquisition community and U.S. industry to "buy national."

EXECUTIVE SUMMARY

THE FREEDOM OF INFORMATION ACT AND FEDERAL ACQUISITION: THE IMPACT OF CHRYSLER CORP. v. BROWN

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The Freedom of Information Act (FOIA) was enacted by Congress in 1967, in part, to eliminate the undue secrecy in government perpetuated by section three of the Administrative Procedure Act which was often used by federal agencies as authority for withholding rather than disclosing information. The FOIA provides that any person, for any reason, can request and receive, for a nominal charge, a copy of any unexempted record of information in the possession of the executive branch of the federal government. The FOIA also provides requesters of information with a remedy in federal district court for wrongful denials of their requests. Under the law requesters may even recover their legal costs from the federal government if they substantially prevail before that court.

Unfortunately much confusion and uncertainty has surrounded exemption four of the FOIA. Although exemption four exempts from mandatory disclosure "trade secrets and commercial or financial information obtained from a person and privileged or confidential," it is not clear whether nondisclosure of exemption four information is mandatory or permissive in nature and whether a submitter of such information is entitled to a trial de novo under the FOIA. The federal courts which have wrestled with the FOIA's ambiguous language have been compelled to look at confusing and conflicting legislative history for guidance. One result has been an abundance of conflicting decisions among the judicial circuits creating much uncertainty in the present state of the law. Consequently the United States Supreme Court has granted certiorari in Chrysler Corp. v. Brown, a "reverse" FOIA lawsuit, the outcome of which should clarify the law. However the Supreme Court's decision could at the same time, significantly impede the government's ability to acquire innovative technology from private industry.

Firms that compete for award of government research and development contracts often reveal in their proposals their confidential innovative solutions to technological problems relying upon the government's promise of confidentiality. Once the executive branch of the government takes possession of those proposals, the information contained therein becomes a record of information subject to release to a requester under the FOIA. The submitters frequently invoke exemption four of the FOIA as authority for nondisclosure. Some courts have ruled that even if the material is within exemption four, the government has the right to release the material if it so choses. If the government elects to release the material, the submitters are compelled to file a "reverse" FOIA lawsuit against the United States for injunctive relief. In this type of lawsuit the firm which has submitted the information brings suit against the government in order to enjoin the government's release of the information to the requester, often an industrial competitor.

Some courts have held that those submitters are not entitled to sue under the FOIA, but rather must sue under the Administrative Procedure Act wherein they are entitled neither to a trial de novo nor to recovery of their legal costs even though a similarly situated requester would have those rights.

If the Court should rule that nondisclosure of exemption four material is permissive, and that a submitter does not have a right to a trial de novo under the FOIA, then, industry may hesitate to completely and openly reveal their innovative concepts to the government, and may also decline to participate in the acquisition process, without effective remedial action. One solution would be either the promulgation of agency directives, under the authority of 5 U.S.C. § 301 or the enactment of a Congressional amendment to the FOIA, to absolutely prohibit the disclosure of exemption four material. Such remedial action would immediately shift the judicial burden from the submitters to the requesters and would further the goals expressed in the proposed acquisition bill by encouraging government contractors to disclose their technological innovations to the government in contract proposals.

The thrust of the present and contemplated acquisition statutes and regulations is to encourage industry to compete in the acquisition process and to reveal their innovative solutions to government problems. Clearly the FOIA as interpreted and applied by some courts fails to serve that end. For these reasons the Supreme Courts decision in Chrysler is of substantial significance to the acquisition community.

EXECUTIVE SUMMARY

ANALYSIS AND IMPACT OF MULTI-YEAR AUTHORIZATIONS

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The use of multiple-year defense authorizations continues to be an area of concern and controversy. Benefits of such funding authorizations through improved long-term planning and economic ordering quantities are clearly evident. Despite the downward trend in military spending, however, the Defense portion of the Federal budget remains the primary factor for manipulating government spending to achieve fiscal control and promote stabilization.

The purpose of the paper is an investigation of the uses, benefits, and impact of multiple-year authorizations. The study begins with a discussion of the types of appropriations that are classified as multiple-year funds and the parameters set forth in federal statutes and the Defense Acquisition Regulation. The costs and benefits of such authorizations are discussed in relation to recent trends in military spending. Hopefully, the study will show some of the hazards of myopic thinking in the area of fiscal control and stabilization policy. Finally, recommendations are made for possible future study for the increased usage of multiple-year authorizations.

EXECUTIVE SUMMARY

A STRUCTURE FOR DEFINING THE SCOPE OF MISSION ELEMENT NEED STATEMENTS

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The paper summarizes efforts to develop terminology and to determine appropriate relationships to facilitate the Naval Air Systems Command's (NAVAIR) responsibilities for translating and processing of approved mission needs into effective and affordable future naval airborne weapon systems. The specific objectives of the analysis completed were to develop criteria defining the scope of a Mission Element Need Statement (MENS) potentially capable of being satisfied by the NAVAIR organization and to show the relationships of these MENS' to other commands and higher level organizations.

Through analysis of the acquisition process, including precedent studies, statuatory regulations, executive orders and implementing actions within the Department of Defense (DOD), some of the basic difficulties, possibly manifested differently in each of the Services, that have arisen in the implementation of the basic policy on acquisition of major weapon systems, set forth in OMB Circular No. A-109, are identified. Two of the more significant of these difficulties are:

- the requirement for expressing mission needs in terms independent of hardware concepts
- the need for improved estimates of life-cycle costs prior to the need for large financial commitments

The major difficulty with these requirements arises due to their contradictory nature. It is pointed out that the greater the accuracy demanded in estimating any resource requirements the more specific and more restrictive must be the design configuration postulated. It is also emphasized that today's constraining environment of increasing costs within a relatively fixed budget portends fewer new systems. Such environment is tending to result in the definition of larger bounded MENS', involving a need for the capability for system integration of larger bounded, problem-solving solutions than have been the existing habit pattern of Government and industry.

The looseness in the definition of current mission needs and in the correlation between the perceived need and the anticipated solution is addressed. A hierarchy of matrices is proposed, with a supporting theoretical discussion,

to provide an approach for better understanding the complex relationships involved and for improving the correlation between NEED and SOLUTIONS. This set of matrices permits the identification of the relationship of requirements (mission needs) established at a higher hierarchal level, such as National Objectives, Roles and Missions or Defense Mission Areas, to be linked to the capabilities of the Navy, and NAVAIR in particular. Although the matrices established specifically address such requirements in relation to NAVAIR, a similar hierarchy of matrices could be evolved for each of the other Services, and other Navy Material Commands.

The urgent need for more specific correlation between the MENS process (authorization process) and the Planning, Programming and Budgeting System used in the appropriation process is indicated. This need is the more urgent due to increased emphasis placed upon determining the affordability of any proposed system to meet a MENS (mission need) requirement. The need for consideration of the affordability of a requirement at all hierarchal levels is shown; e.g., at higher hierarchal levels, the priority must be established as to the relative importance at that level of that requirement, with its associated costs, as well as the probability of the need within the time period under consideration.

The suggested matrices, scope and procedures are proposed as a potential approach for furthering the effective implementation of A-109 within the Navy, especially NAVAIR.

EXECUTIVE SUMMARY

DESIGN TO AFFORDABILITY - AS VIEWED BY KEY PEOPLE IN ONE INDUSTRIAL CONCERN

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This paper presents some industry views on Design to Affordability and contains suggestions for making this concept a more effective acquisition tool. The material is drawn from two company wide Design-to-Cost conferences held by the Hughes Aircraft Company, and recent experience in complying with A-109 acquisition policy.

Definition of Requirements - Experience shows that industry should participate with the government very early in the acquisition process. Otherwise, neither government nor industry will have a sufficiently clear understanding of the mission need or the parameters chosen to define system requirements for the program to go through the acquisition process effectively. Industry participation in such areas as threat evaluation, mission need analysis, priority setting, identification of alternative concepts, system analysis, performance parameter definition, and cost analysis should be increased.

Poor definition and communication of requirements and criteria for decision making can result in waste of time, talent, and money on the part of industry and government alike. This conclusion is based on experience with a wide variety of programs from all three of the military services. It was found that the objectives and decision making criteria were not consistent among the different customers or the different tiers within a single customer's management hierarchy. This leads to confusion and misdirected effort. It results in industry trying to determine what "the real customer really wants" and designing to that objective rather than designing to known criteria of performance, schedule, and cost.

With clear and reasonable objectives industry is able to achieve both cost and performance goals. There was evidence on each program reviewed in the company wide conferences that industry could establish design-to-cost goals and manage the iterative design and cost control process required to meet these goals.

Of course, more funding is required by both government and industry in the initial phases of the acquisition process to support the early work needed for the design to affordability approach. More money is needed for the mission analysis phase, and for trade-offs, design iterations, vendor requotes, producibility studies, etc. during the concept phase and the validation phase. This early investment will be offset by reduced weapon system life cycle costs.

Cost Analysis - The costing load has been greatly increased by the design-to-life cycle cost approach. All phases of the life cycle must be costed. Funding requirements must be scoped and relative cost of various approaches to meet mission needs must be estimated early in the acquisition process. System costs must be broken down into subsystem costs, and these in turn to system elements with specific design parameters identified. Often there is a

proliferation of options that must be costed. Each trade-off study involves cost analysis. Cost credibility is growing in importance as cost becomes a more significant factor in decision making.

The result is the need for development of improved cost analysis techniques, models, cost accounting systems (particularly of operational and support costs), cost history data bases, and skilled personnel to use them. Also, there must be a shift away from detail cost estimating and auditing toward a parametric approach, or financial analysis will not be able to keep pace with and support the technical analysis.

What Do We Do Differently - Implementation of Design to Affordability in the system acquisition process institutes some real changes in operation for both government and industry. The affordability limits or "real cost objectives of the real customer" are established very early in the program. Using parametric cost analysis, firm cost goals that must be adhered to are set for system elements. Engineering, Manufacturing, and Logistics must all participate in the design process from the earliest phases. Cost, performance, and schedule parameters must be balanced in trade-offs. Early trade-offs and associated cost estimates require industry to initiate configuration identification and control for system hardware while the design is still evolving. Tracking and reporting of current estimates of future life cycle costs are required. Projected cost comparisons must be fed back to designers on a near real time basis. New contract incentives and warranties are being used to drive programs toward cost objectives. Program management must achieve the cost goals as well as meeting performance and schedule requirements.

Summary - Industry should participate with the government early in the acquisition process when mission elements are prioritized and affordability limits are being established. Good definition of requirements, limitations, and criteria for decision making and communication of them to the procuring commands and industry is essential for Design to Affordability to become an effective acquisition tool. Development of adequate cost analysis capability is also necessary, with a shift to reliance on parametric techniques for cost estimating and review rather than detailed costing. These policy changes together with other changes in technique will enable program management to achieve reasonable cost and performance goals and provide for needed national defense.

EXECUTIVE SUMMARY

WHY SIRCS FAILED: THE PUBLIC RECORD

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Ever since World War II the Congress has wrestled with the problem of seemingly uncontrollable spending for military weapon systems. When McNamara's hyper-rationality failed to stem the flow of Pentagon overruns, Congress in 1969 chartered its own Commission on Government Procurement to recommend remedial action. Out of 149 Commission recommendations promulgated in early 1973, twelve of them were directed specifically at the problem of acquiring so-called "major" systems. Later promulgated for Executive agency use as OMB Circular No. A-109, these recommendations became policy with the force of law in 1976. They emphasize a requirement for specific agency head approval to start a program and extensive front-end conceptualization by competing private sector design teams in order to capture industry's ability to innovate. Under A-109 government carefully refrains from indicating a preference for any particular choice of types or configurations of equipments to satisfy an agency's specified mission "need" (i.e., shortfall). The role of government in-house technical competence is to educate, monitor, and control but not to specify in a direct manner.

The year 1973 also saw official endorsement of the Defense Science Board's scheme for "Design to Cost" acquisition of major systems. The fall of 1973 brought the sudden Arab-Israeli War. Among its convincing combat demonstrations was an exchange of GABRIEL and STYX anti-ship missiles, won by the Israelis. In the spring of 1974 the Research and Development Subcommittee of the House Committee on Armed Services launched a deliberate campaign to goad the U.S. Navy into upgrading the capabilities of individual ships to defend themselves against air attack and to be able to strike at enemy surface and shore targets. In October, 1974, the Navy began a determined effort to draft a statement of requirements for a Shipboard Intermediate Range Combat System (SIRCS). Design to Cost and the recommendations of the Commission on Government Procurement were adopted in evolving an acquisition strategy. The result was a commendably short, three page Operational Requirement that was purposely non-specific on whether guns or missiles, or some combination, would be the mechanism for system kill. A government project team was formed in April, 1975, headquartered within the existing Navy program office for Anti-Ship Missile Defense. Strong technical participation by the Navy laboratory community was emphasized. An extensive technical data bank of Government Furnished Information was established for contractor design team use. By the spring of 1976 McDonnell-Douglas, Raytheon, and RCA were deemed the best of seven qualified offerors to proceed

with funded nine month conceptual studies. During this period the Office of the Secretary of Defense designated SIRCS to Congress as being a model A-109 development. Unimpressed by A-109 the House Armed Services Committee deleted the SIRCS $16 million budget request for FY 1977. Only compromise in conference got $2 million restored to complete the studies. The House Appropriations Committee then deleted SIRCS funding because it wanted to see a common missile developed for SIRCS and a pending Marine Corps requirement. Finally, the Senate Appropriations Committee supported SIRCS for FY 1977 by getting the $2 million restored. The committee vigorously endorsed the program's A-109 compliance. Also in the FY 1977 bill was $5 million for the Air Force and the Navy jointly to begin to develop a replacement for SPARROW known as AMRAAM (Advanced Medium Range Air-to-Air Missile).

By the time of convening of the next Congress in January, 1977, the General Accounting Office had finished a SIRCS program review and certified that it was proceeding ". . . consistent with the Commission's intent." As the FY 1978 budget hearings began the results of the three contractor conceptual designs became known. Each had formulated the need to develop a new surface-to-air missile as the principal weapon for SIRCS. Piqued, the House Armed Services Committee deleted all SIRCS funding and the Senate Armed Services Committee expressed concern that SIRCS/AMRAAM commonality was being ignored. It should be noted that Raytheon was both a SIRCS design contractor and a leading AMRAAM competitor. Also, the Raytheon developed SPARROW missile was in common use by the Air Force, naval aviation, and the surface Navy. Final resolution of the FY 1978 authorization for SIRCS was approved by the Congressional conferees at $3.9 million if the Navy would define a new "baseline" design specification containing the best features of the three funded studies. A new industry open competition was to be held with Navy break-out of component systems encouraged. Navy management interpreted the sense of the authorization bill (PL 95-79) as direction to proceed with SIRCS only as an exception to A-109. Some time later the FY 1978 DOD Appropriations Bill (PL 95-111) directed the Navy to continue SIRCS in accordance with A-109. In the fall of 1977 the Navy dropped RCA as a SIRCS design competitor. The program was continued in accordance with A-109 because PL 95-111 chronologically was the later of the two conflicting pieces of legislation.

In the next session of Congress the FY 1979 Department of Defense Appropriations Authorization Bill contained no funds for SIRCS. "The first comprehensive attempt to implement the policies of OMB Circular A-109" was dead. The fleet still waits for a modern surface combat system.

EXECUTIVE SUMMARY

SOCIO-ECONOMIC OBJECTIVES - AN EXAMINATION OF THEIR IMPACT ON CIVIL AGENCIES AND THE DEPARTMENT OF DEFENSE

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Two of the first attempts to use the Federal acquisition process for implementing socio-economic policies were the Naval Service Appropriation Act of 1865 and the Army Appropriation Act of 1876. These policies mandated the purchase of only American bunting and preferred American labor and materials for public improvement contracts. Many others have followed as the Federal Government has sought to achieve social change through its acquisition of goods and services.

In its 1972 report, the Commission on Government Procurement, exploring the ways the acquisition process has been employed to further social goals, identified 39 such programs. It concluded: the "cumulative effect of programs(socioeconomic) already imposed on the procurement process and the addition of those contemplated could overburden it to the point of threatening breakdown."[1] As a result, the COGP made three recommendations which were accepted by both the Executive and Legislative Branches of the Federal Government. These were:

> Recommendation 43. Establish a comprehensive program for legislative and executive branch reexamination of the full range of social and economic programs applied to the procurement process and the administrative practices followed in their application.
>
> Recommendation 44. Raise to $10,000 the minimum level at which social and economic programs are applied to the procurement process.
>
> Recommendation 45. Consider means to make the costs of implementing social and economic goals through the procurement process more visible.

The COGP recommendations, except in the case of the Miller Act, have not been acted upon. In fact, the Congress has felt it appropriate to expand socioeconomic coverage. For example, the small business and minority business areas have been expanded already, and extended coverage and emphasis are being contemplated with the urban area, labor surplus, Buy-American and anti-inflation.

Research conducted in the Summer,Fall and Winter of 1978 investigated the impact of using the contract as a vehicle for accomplishing socio-economic objectives. Within eight large civil agencies(Departments of Agriculture,Commerce, Energy, Health-Education-Welfare, Housing-Urban Development,Labor, Transportation; National Aeronautics and Space Administration;Small Business Administration),middle and top managers(GS-13 through Assistant Secretaries) were interviewed. Study objectives were to assess the relative priorities between agency

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[1] U.S. Commission on Government Procurement, Report of the Commission on Government Procurement, Volume 1(Wash.,DC:GPO, 1972), p.111.

primary missions and socio-economic goals. In the DOD half of the study,many military service organizations were visited and attempts made to identify and quantify the burden(or cost) of organizational and personnel activities generated primarily by socio-economic statutes and directives.

While neither research project is complete at this time, it is clear that additional research must be conducted, particularly in the area of evaluating more accurately the costs and benefits associated with using the federal contract/grant process as the dominant vehicle for directing federal dollars toward socio-economic goals. Clearly, using the contract as the vehicle has incurred very high direct and indirect costs. A major concern is with the lack of approved formal procedures for comparing these costs with the expected or actual benefits. In the civil agencies, in particular, it is possible that another approach(than use of the contract clause) would be more efficient and effective, especially considering the serious defects in contract administration activities of some agencies.

Aside from the question of adequacy or necessity for administration of grants and contracts, there is considerable confusion-among government managers of all ranks and grades- as to how they should deal with traditional values -- such as competition,product quality, timely delivery, and reasonable cost.Sometime,top-level pressures appear to ignore these values in favor of awards intended solely to meet politically-based administrative quotas. Due primarily to the depth of commitment to these values, there is strong resistance to supporting specific socio-economic programs that appear to degrade agency missions.

It was the purpose of this joint effort to provide a systematic examination of the burdens and mission-related effects of the socio-economic burdens. We have attempted to explore objectively the nature and scope of the actual burdens, their sources and the organizations bearing the brunt of the expenses. This information should provide a framework against which the Executive and Legislative branches can evaluate rationally available and future information. We expect the next step should be addressing the important question,"Should socio-economic programs be implemented through the contract/procurement/acquisition process, or is there a better, more productive approach?"

EXECUTIVE SUMMARY

INCREASED ASSET AVAILABILITY THRU INCENTIVE CONTRACTING

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BACKGROUND

The Navy Ships Parts Control Center (NSPCC) is responsible for the supply support of Hull, Mechanical, Electronic and Ordnance equipment of which approximately 70,000 line items are classified as repairable. It is Navy policy to accomplish the repair of these repairable items to the maximum practical extent "in house" at Naval Ship Repair Facilities. Of the total annual requirements for repair of repairables, approximately 55% are accomplished by 23 Naval Ship Repair Facilities and 45% at approximately 280 commercial designated overhaul points. An initial in-depth analysis of the 70,000 repairable items performed in October 1974, identified 906 items as critical mission essential items. This figure has currently been expanded to 2,223 items.

Based on the foregoing, the NSPCC initiated the "Fleet Intensified Repairables Management Program" (FIRM) to provide intensive management of expensive, high demand, critical shipboard repairable components. Although the program's objectives were realized in the sense that repair turn-around-times were reduced, problems surfaced in the low repair survival rates of klystron, magnitron and other tube types utilized in radar systems. Nine tube types fell into this category with survival rates ranging from 23% to 90% and averaging 57%.

DEFINITION OF PROBLEMS

In spite of three years experience under incentive contracting, the Navy's problem remained unchanged--lack of available assets. Further reviews highlighted the relatively low survival rate as the primary problem. SPCC's Fiscal Year 1979 workload forecast projected a total of 664 tubes available for repair. Historically speaking, 286 tubes or 43% of all inducted for repair would be scrapped and replaced by new acquisition. Furthermore, the acquisition process would encompass approximately 9 to 12 months from the initiation of a contractual action to the delivery of the first item. Speaking dollar wise, the same tube types range in value from $3,000 to $16,000 each. Therefore, the investment becomes even more dramatic if it involves the procurement of 100 tubes valued at $16,000 each with delivery spread over a period of 12 - 15 months. The long production leadtimes plus low overhaul yield obviously caused excessive costs in supply support.

NEGOTIATIONS

Facing the realization that further delays would only compound the non-availability problem, the contracting officer approached Varian Associates for the express purpose of increasing the overhaul and repair yield to 100%. Subsequent to Varian's affirmative response, the SPCC sent a team to the contractor's facility to discuss their position and negotiate an equitable settlement. These negotiations culminated in the following agreements:

a. Minor and major repairs would be accomplished within 60 and 90 days after induction respectively.

b. Scrapped tubes would be inducted under a total rebuild program which would essentially guarantee a 100% return of all tubes inducted.

c. Incentive dollars would be available to be earned for the successful overhaul and repair of all tubes inducted.

d. The Government would provide long leadtime piece parts on a one time basis.

e. Firm fixed prices would be negotiated for each stage of repair.

ANTICIPATED BENEFITS

Obviously, the Navy would not invest incentive dollars and Government furnished piece parts if it did not expect a substantial return on its investment. The major benefits achieved are summarized as follows:

a. Increases the overhaul yield to 100%.

b. Reduces money investment time from 12 months to 2 months.

c. Improves repairables management.

d. Reduces average turn around time from 7 months to 2 months.

e. Eliminates the need for new procurement actions except for minor attrition.

Although each of the above benefits is substantial in its own right, the most devastating benefit is the potential cost savings of six to nine millions of dollars in reduced pipeline support costs. The actual amount of the cost savings shall be determined by the number of tubes inducted during the fiscal year. Accordingly, the estimated quantities and amounts are summarized in cost formula format within the final manuscript.

EXECUTIVE SUMMARY

LIFE CYCLE COST COMPARISONS USING COST DIFFERENCES

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Life cycle costing is an important element in determining the affordability of defense systems and equipment. Recognition of the importance of life cycle costing has resulted in the collection of detailed operating and support costs. Emphasis on life cycle costing, and the availablility of operating and support cost history has increased the knowledge of true life cycle costs of weapons and equipment, but it has also increased the complexity of the cost estimating process. There are situations in which alternative investments are being compared, and for which only life cycle cost differences are necessary for the decision making process. A method has been devised for comparing only the differences in life cycle cost and not the total life cycle cost as a basis for selecting an alternative. This method has been used in comparing alternative administrative vehicles, but should be applicable in a number of other situations. The specific problem considered in this report concerns the selection between US manufactured administrative vehicles and administrative vehicles manufactured in the host nation for use by US forces in the host nation.

Cost elements were divided into two groups: (1) costs common to both vehicles, and (2) costs in which differences were likely to occur. Cost elements common to both vehicles included driver costs, maintenance facilities costs, and basic tool costs. Cost elements in which differences were likely to occur included procurement, transportation, maintenance labor, spare parts, fuel, and salvage value.

Procurement costs were obtained from the Military Service inventory control points for the US vehicles, and from current quotes for the host nation vehicle. Operating and maintenance costs were obtained from motor pool records for both US vehicle and for host nation vehicles operated by host nation forces. Salvage values were obtained from US and host nation property disposal activities. In order to avoid inconsistencies caused by differing methods for allocating overhead, fuel costs were collected as miles per gallon; and maintenance labor was collected as average hours per year for each vehicle type. Annual operating cost was obtained by extending the data using fuel cost, labor cost, and miles operated at values applicable to US forces.

A cost summary sheet was prepared for each vehicle type. The cost summary sheet compared the following cost elements:

	US VEHICLE	HOST NATION VEHICLE
ACQUISITION COSTS:		
Procurement Cost	-----	-----

	US VEHICLE	HOST NATION VEHICLE
Transportation Cost	-----	-----
Delivered Cost	-----	-----
AVERAGE YEARLY OPERATING AND SUPPORT COST:		
Maintenance Manhours	-----	-----
Direct Material Dollars	-----	-----
Miles Per Gallon	-----	-----
ANNUAL OWN AND OPERATE COSTS:		
Ownership Cost ($/yr)	-----	-----
Labor Cost ($/yr)	-----	-----
Material Cost ($/yr)	-----	-----
Fuel Cost ($/yr)	-----	-----
Salvage Value ($/yr)	-----	-----
Annual Own/Operate Cost ($)	-----	-----

The annual own and operate costs were used as a comparison of the relative cost effectiveness of the US vehicle versus the host nation vehicle. Differences between the annual own and operate costs were multiplied by the number of each vehicle type now in operation by US forces to determine the cost effectiveness of the individual vehicle types, and summarized to determine the cost effectiveness of the entire program.

To date, this method of analyzing life cycle cost differences has been employed in administrative vehicle cost studies in the Federal Republic of Germany (FRG), the United Kingdom (UK), and in Italy. Conversion to host nation administrative vehicles of specific types, based on these studies, have been approved in the FRG and in the UK. The analysis of life cycle cost differences appears to be applicable to a range of problems involving the evaluation of alternative investments. While this method of analysis does not arrive at a total life cycle cost, it does provide a means of selecting alternative investments on a life cycle cost basis.

EXECUTIVE SUMMARY

AN EXPLORATION OF THE RELATIONSHIP BETWEEN MANUFACTURING REWORK EVENTS AND FIELD FAILURE RATES

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The Product Engineering Services Office (PESO) is under the general direction of the Office of the Deputy Under Secretary of Defense for Research and Engineering (Acquisition Policy). PESO's functions include the performance of engineering reviews to provide independent evaluations of systems readiness for production. During a production readiness review on a major weapon system the team noticed that the repairable units that were being returned to the depot repair facility reflected failures that coincided with the areas of "low yield" in the manufacturing process. They also noticed that a significant amount of rework was required during the manufacturing process to make initial deliveries. This raised serious questions as to the reliability and producibility of the designed hardware. Based on this experience, a study was initiated to gather data on the relationships between low yield/high rework rates and excessive field failure rates.

To understand the study effort it should first be established what is meant by "yield" and "rework rate" and their relationship to each other.

For the purposes of this study, manufacturing yield is the percentage of units (components, subassemblies, or assemblies) which pass functional test the first time. The maximum yield possible is 100 percent; the minimum is 0 percent. Rework rate is the average number of times an item is reworked. For a specific printed circuit board assembly type, rework rate would be the total number of times the board assemblies were reworked divided by the number of board assemblies accepted.

Yield and rework rate are indicators of a design's producibility and effectiveness of manufacturing process control. If producibility is adequately considered during design, production results should be repeatable. If process controls are effective so that each manufacturing operation makes the same item, time after time, the amount of rework necessary to pass the acceptance test will be minimal. Since there is a strong relationship between factory yield/rework rates and rigorous process controls; and there is a strong relationship between process controls and operational reliability; it should be expected that yield/rework rates correlate with operational reliability. Figure 1 shows the expected relationship between manufacturing yield and field failure rate. An item having a high yield will have fewer field problems (lower field failure rate) than the same item having a low yield. The sensitivity of the item to variations in yield rates (the slope of the curve) will increase in proportion to the increase in complexity, density, etc.

Excessive reworking of an item degrades the item's reliability. This relationship is shown in figure 2. As a printed circuit board assembly is reworked stresses are induced by the hot soldering iron. These stresses may result in lifted pads and delamination on multi-layered PCBs. Each repair or rework is another opportunity to induce a failure. The shapes of the curves in figures 1 and 2 are indications of this trend. As above, the sensitivity will increase as the number of layers, density, etc. increases.

Phase I of the study established that the relationships warrant further study and data collection. Phase II established the objectives of the study as:

1. To provide guidelines for identifying, during development, manufacturing yield/rework problems likely to persist during the production and operating phases.

2. To provide numerical guidelines for determining when process yield/rework rates are "in control."

3. To develop statistical indicators for production readiness reviews and risk assessments.

4. To initiate development of techniques to include production yield and rework rates in the prediction of field failure rates.

In Phase III (the present phase) data collection began. During Phase III it was discovered that the Navy was performing a similar effort. The End Item Data Package Program, a derivation of a NASA concept, has added program visibility of production processes by looking at production data in a slightly different manner than normally done. A complete failure history (including the number of solder defects, Material Review Board actions, contaminations and component replacements) is attached to each assembly at final acceptance. Variations in rework events focus management attention on problem areas that cannot be found using conventional trend analysis.

The study is not complete. Problems with data collection have prevented PESO from establishing these relationships. However, data collection efforts are continuing and will result in definite DoD guidelines for use of these indicators.

In Phase IV guidelines will be established to limit the yield and rework rate acceptable for printed circuit board assemblies taking into account characteristics of the assembly (such as complexity, number of layers, and density). These guidelines will provide program managers and contractors with greater visibility of the manufacturing process, and lower operation and support cost as a result of higher field reliability.

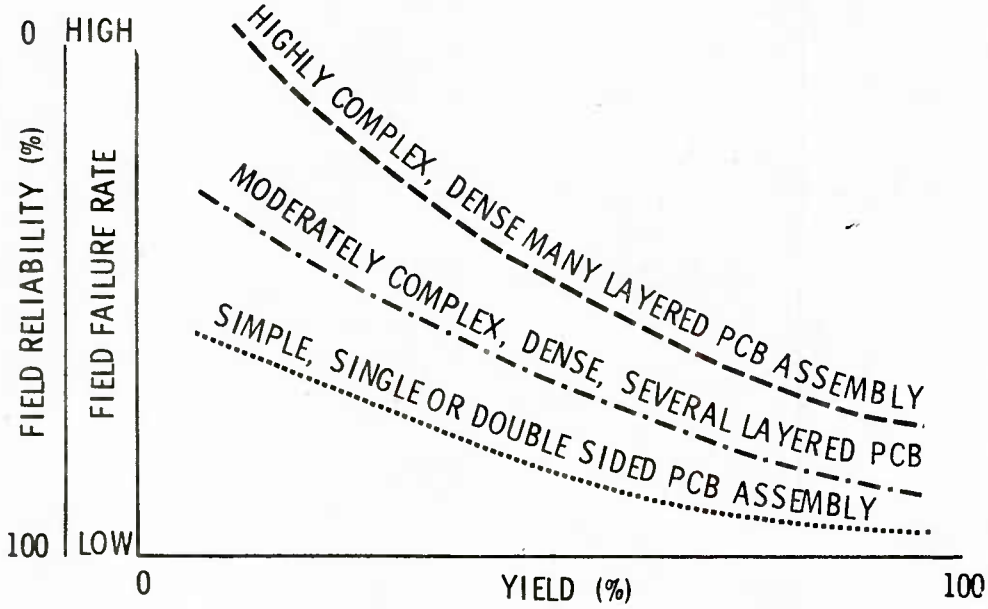

FIGURE 1. YIELD VS. FIELD FAILURE RATE

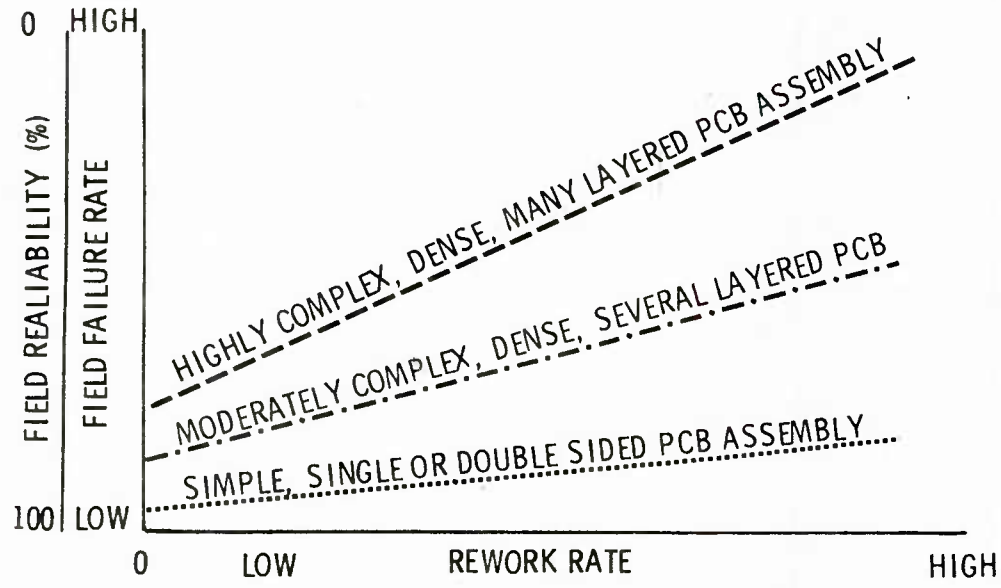

FIGURE 2. REWORK RATE VS. FIELD FAILURE RATE

EXECUTIVE SUMMARY

BASELINE INDICATORS OF PRODUCTION READINESS

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Evaluating the production readiness of a weapon system prior to the production decision point is an important element of the DoD weapon system acquisition process. Production readiness is assessed by means of a Production Readiness Review (PRR). Department of Defense Instruction 5000.38, titled "Production Readiness Reviews," defines the purpose of a PRR as follows: "The objective of a PRR is to verify that the production design, planning, and associated preparations for a system have progressed to the point where a production commitment can be made without incurring unacceptable risks of breaching thresholds of schedule, performance, cost, or other established criteria." The criteria used to establish production readiness has consisted of a series of largely subjective judgements, with guidance provided by checklists. The Product Engineering Services Office undertook a study to establish meaningful and measurable indicators of production readiness based on data that is normally required as part of defense contracts. Preliminary findings of this study indicate that various elements of production readiness can be measured. Additionally, it has been determined that while each system is unique, there exists a number of common characteristics which can be compared on a system-by-system basis. The following list of baseline indicators was established:

HARDWARE INDICATORS

1. Engineering Change Traffic Profiles
2. Reliability Growth Patterns
3. Yield Rates for Special Manufacturing Processes
4. Yield Rates for Test Operations
5. Scrap and Rework Levels
6. Level of Effort on Noncomforming Materials
7. Out of Station Work Performed

SOFTWARE INDICATORS

1. Rate of Discovery of Errors
2. Rate of Change of Requirements

3. Rate of Change of Revision Level

4. Percent Memory and Speed Capacity Uncommitted

Preliminary findings indicate engineering change traffic profiles to be one of the best indicators of production readiness. They are graphic representations of the number of engineering changes made per month prior to the production milestone. The shape of this change curve proved to be similar for diverse systems including guns, aircraft, electronic systems, and tracked vehicles. The curve shape is sufficiently defined such that anomalies can be identified and investigated. The engineering change traffic profile appears to be a sensitive indicator of the design maturity of a system. The cause and effect relationship between engineering changes and acquisition cost growth is well understood, but remains to be quantified. This quantification will be investigated during Phase II of the study.

The analysis of reliability growth patterns is also a good indicator of production readiness. Reliability growth patterns have been under study for several years and graphic methods for projecting this growth have been devised. The basic principles involved in reliability growth analysis appear to be applicable to growth projections for both special manufacturing process yield and yield rates for test operations. Acquisition costs are sensitive to test and process yields, and operating and support costs are sensitive to inherent system reliability.

Learning curve techniques, generally associated with direct labor requirements estimating, appear to have application in projection of future values for scrap and rework levels as well as the level of effort expended in connection with nonconforming materials. Both of these factors are cost drivers relative to acquisition costs.

The magnitude of out-of-station work performed provides a symptom for a wide variety of problems including design, production, and subcontractor difficulties.

Through the examination of data from previous software programs, repetitive patterns have appeared for the rate of discovery of errors, rate of change of requirements, and rate of change of revision level. Substantial variation from these patterns may indicate problems requiring solution. The percent of memory and speed capacity yet uncommitted appears to be a promising indicator, but additional data must be accumulated before this indicator can be quantified.

The first phase of the baseline indicators study has identified a list of measurable indicators, established methods for their analysis, and resulted in the collection of a substantial amount of empirical data from existing programs. The next phase of the study will be devoted to establishing the relationship between the initial values for the indicators, acquisition cost, and schedule performance.

EXECUTIVE SUMMARY

ACQUISITION COSTING IN THE FEDERAL GOVERNMENT

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In early 1978, the Logistics Management Institute (LMI) undertook a review of costing in the Federal acquisition process. That review was part of a larger effort intended to provide information on costing models and techniques which would be useful to a number of Federal departments and agencies. This paper presents and discusses that portion of the review concerning the improvement of cost estimating, cost analysis and price analysis in the Federal acquisition process.

There is a general perception that Federal projects suffer from consistent cost overruns. Because of this perception, there is pressure to make "better estimates." The GAO periodically studies major Federal acquisitions and attempts to determine the causes of overruns. In its 1978 study, the GAO reviewed causal factors for 200 acquisitions with a total value of $177 billion. For those acquisitions, the total cost change attributed to estimating error was 7.1 percent of the baseline estimate--a value well within the bounds of acceptable estimating error. Our examination of the GAO data indicates that the total error would be even lower if it were not for the fact that a few projects had such large estimating errors that their inclusion biases the results.

From this analysis, we cannot conclude that major changes are needed in methods, techniques, or personnel. There is an apparent need for specific training of some individuals and offices. There is also an indication that the practices of the Department of Defense and NASA should be considered by those departments and agencies engaged in new technology or complex acquisitions.

Even though our primary conclusion is that major remedial changes are neither necessary nor desirable, this does not mean that no improvements can be made. Indeed, there are several actions which can be taken to upgrade capability and improve the total costing effort.

A significant problem area is communication between offices and individuals providing estimates at different points in the acquisition process. The separation of costing by functional boundaries (program management, budgeting, contracting and contract administration) is the primary impediment to the transfer of costing information. This separation has had the effect of making costing a functional sub-set performed by estimators identified with discrete functions who are remote from their counterparts attached to other functions. This lack of communication is also manifested through problems in estimate traceability, data availability, and use of techniques and

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methods having common applicability. If cost estimating and cost and price analysis, taken together, are recognized as a continuum which serves each part of the acquisition process, its role as an ongoing function, integral to the whole process, becomes clear.

Our recommendation is to unify the costing function into those offices having management overview of the acquisition process. Since the location of this total program management function differs among departments and agencies, the placement of unified costing offices should also differ in order to maximize their effectiveness and efficiency. Regardless of the organizational alignment which might be adopted by agencies, unification should produce improved communicaiton opportunities, both intra and interagency; exchange and use of appropriate techniques; continuity in data use and feedback and traceability of information pertaining to program and contract changes with their concomitant cost changes.

As noted above, the data indicated a need for training in specific locations and subjects. Recommendations were given on subjects which were perceived by acquisition managers to need training courses and materials.

EXECUTIVE SUMMARY

DETERMINING AND FORECASTING SAVINGS DUE TO COMPETITION

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BACKGROUND

The need for competition in the Government's acquisition of goods and services is continually stressed by Congress, members of the press and the Government itself. The addage that competition saves money may not be true in all instances throughout the entire range of the Government's purchasing requirements. Each individual acquisition should be evaluated to determine if competition will, in fact, be cost effective.

However, it is difficult to isolate, to identify, and to quantify the impact of competition on acquisition costs. Traditionally, a 25% savings is expected, but there is no empirical support for such expectation. Actually, the Government has no firm basis for deciding when to introduce competition or even if competition should be introduced. When the value of competition cannot be measured with a reasonable degree of confidence, defense of budgetry estimates and the development of a successful acquisition strategy is exceedingly difficult, if not impossible.

To address these problems the authors conducted a study of competition in the production of various items procured by the Government.

RESEARCH OBJECTIVES AND APPROACH

The major objectives of this research effort were to:

1. develop a methodology for estimating the net savings achieved due to competition; and

2. develop a methodology to forecast the net savings expected from introducing competition into the acquisition of future items.

To achieve these objectives the approach taken included:

1. a thorough investigation of the acquisition histories of sixteen items which were originally produced on a sole source basis and were later competed;

2. the identification and analysis of factors explaining savings due to competition; and

3. the synthesis of these factors into workable methodologies.

SAVINGS METHODOLOGIES

The methodology developed to estimate net savings is basically an accounting model with savings debits and savings credits. In addition to hardware costs, it takes into consideration nonrecurring and start-up costs, learning, and inflation.

There are three major parts to the forecasted savings methodology. The first is a competition screen or set of criteria that must be met in order to consider competition. The second part is a forecasting model which provides an estimate of expected savings by considering those quantitative factors which affect savings. The third part is a competition index which summarizes an analysis of the qualitative factors influencing savings.

CONCLUSIONS

The savings achieved by introducing competition into the Government's acquisition process can be estimated accurately. Of the sixteen items analyzed, five showed a loss due to competition. Overall, savings for the sixteen items averaged 10.8 percent. The forecasted savings methodology is a useful technique which provides an estimate of the expected savings or loss, from introducing competition, as well as an analysis of the qualitative factors influencing competition.

EXECUTIVE SUMMARY

STRATEGIC MANAGEMENT IMPLICATIONS FOR THE ACQUISITION DECISION PROCESS

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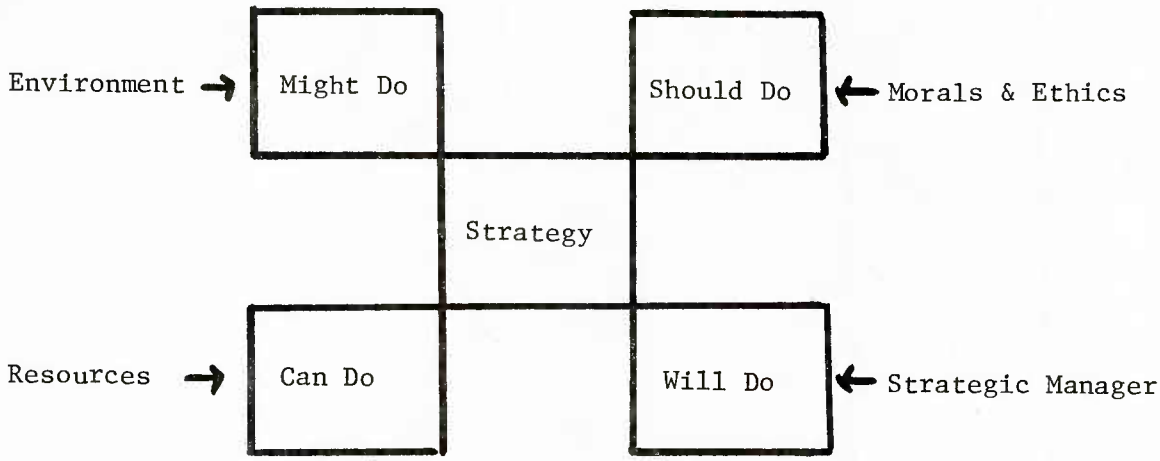
Strategic management is commonly recognized as the function of top managers of an organization, whether industry or government. However, strategic decisions are also made at other functional levels throughout an organization. An understanding of strategic management concepts is highly desirable, even among functional managers, since these functional managers must interact continuously with top management. In so doing, they need to be able to present issues and recommendations in a context which can readily mesh with top managers' viewpoints.

This paper describes strategic management and its relation to other functional areas and to business policy, and presents a concept of strategy determinants. (See Table 1.)

Table 1. Strategy Determinants



It also identifies the types of courses typically included in a strategic management curriculum and discusses some of the research opportunities awaiting exploration in the fields of strategic management. Finally, it concludes with a discussion of some of the implications of strategic management for the acquisition decision process.

EXECUTIVE SUMMARY

SOCIO-ECONOMIC IMPACT ON ACQUISITION MANAGEMENT

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Use of the federal contract as an instrument of social change has been long established, yet do we fully understand where we are headed and what impact these programs will have on the Acquisition Manager? A brief examination of a few of the more recent changes in acquisition policy may provide an answer.

Passage of Public Law 95-507 has had a profound impact on the acquisition process. Now procurements under $10,000 are to be reserved exclusively for small business concerns. Prime and subcontractors with contracts over $500,000 must have acceptable subcontracting plans which include percentage goals for awards to small businesses and small socially and economically disadvantaged businesses. Failure to comply with the clause or plan is a material breach of contract.

Reservation of these awards under $10,000 for small businesses may displace present suppliers and failure to comply with the goals may result in termination for default of key prime contractors. Some firms may escape from their bid obligations under formal advertising by deliberately failing to provide an acceptable plan. There is a potential conflict between P.L. 95-507 and P.L. 95-89 due to a lack of clarity regarding whether P.L. 95-507 supercedes the policy in P.L. 95-89 with regard to awards to large businesses as labor surplus area concerns.

The establishment of a $2,500 threshold for implementation of the labor surplus area program, along with the $2,000 threshold for application of the Service Contract Act and $2,500 for application of Davis-Bacon is contrary to the intent of the simplified small purchases procedures. Consequently the simplified small purchase procedures have yet to be completely "simplified."

There is an apparent conflict between the application of the Resources Conservation and Recovery Act and the Energy Policy and Conservation Act in the procurement process. Guidance is needed as to the priority of one over the other and in order to effectively implement the latter, there is a need for efficiency labels and prescribed energy efficiency standards for most products.

But what about the future? All indications are that the roller coaster is still picking up speed. The voluntary wage and price guidlines will be applied to lower priced contracts. The Joint House-Senate Small Business Committees have warned that "if the Executive Branch does not develop and achieve small business R&D targets, the Committees will reopen the question of percentage standards by hearings or otherwise." Rep. Drinan has introduced HR-291 which would permit SBA to specify categories of procurements for which the agencies would be required to increase the percentage of dollar value furnished by small businesses until the total reached 20% of that category.

There is little likelihood that there will be a reduction in socio-economic restrictions placed on the procurement process. The seriousness with which industry and some Congressional leaders view the use of the federal contract to implement socio-economic policy was evidence in the way in which the current

Administration had to back off the provisions of the multinational trade agreement which would have reduced the impact of the Buy America Act.

The Acquisition Manager must take time to become conversant with our national objectives so as to include them in the acquisition planning. Additionally by surfacing the problems and communicating them to higher level officials, there is a chance for change. Program personnel need to be trained in these socio-economic considerations so as to improve the efficiency and effectiveness of program operations.

The future depends upon the Acquisition Manager assuming a larger role in the implementation of socio-economic policy. Now is the time to take a more active part in assuring that the expectations of these social objectives can be met through the use of the federal contract.